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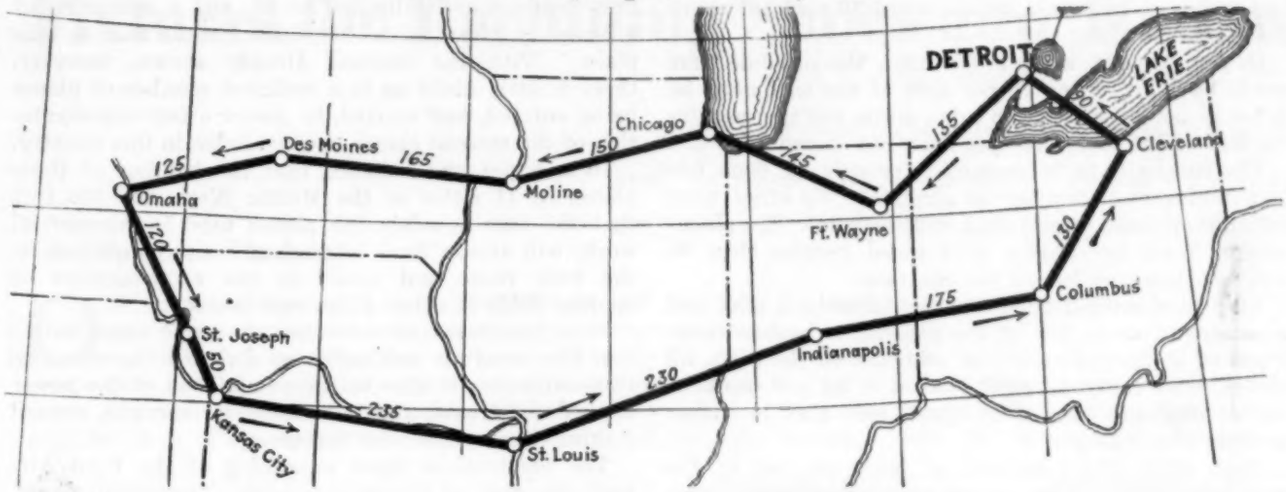

Air Tour

For Commercial Planes—1,750 Miles

Special Correspondence

WHILE automobile races had their place in developing the present-day motor car, the average user was influenced much more strongly by the results of the Glidden reliability tours that were run for several years. The cars that made a good showing under the trying conditions to which the entrants of these tours were subjected at times, had just claim to favor by those who wanted a reliable method of transportation.

With these tours in mind, the first Commercial Airplane Reliability Tour ever held in America will start from the Ford Airport, Dearborn, Mich., on Sept. 28, for a 1,750-mile tour. Eleven cities will be visited: Fort Wayne, Ind.; Chicago, Ill.; Moline, Ill.; Des Moines, Iowa; Omaha, Neb.; St. Joseph, Kansas City and St. Louis, Mo.; Indianapolis, Ind.; Columbus and Cleveland, Ohio, returning to Dearborn on October 3. The trophy has been donated by Edsel B. Ford who is greatly interested in developing commercial aviation. The Ford Airport will be open to all, both aviators and those who are interested, during the week mentioned.

Other events are being arranged for the times while the commercial planes are on the tour. There will be a balloon race, demonstration of night flying and, perhaps most interesting of all, an exposition of aircraft and aircraft accessories. The whole affair is for the purpose of demonstrating the practicality of commercial aircraft, and is not in any sense an exhibition where profits are considered. Exhibition space is free, the entrance fee being returned when the exhibit is received and put in position. The fee is simply to insure that the space asked for will be occupied, so that visitors may have a worthwhile exhibit.

It should be remembered that this is a reliability tour and not a race in any sense. The pilot of each contesting plane will be provided with a schedule that will show the time of departure and arrival at each control station, based on a speed of 80 m.p.h. For a

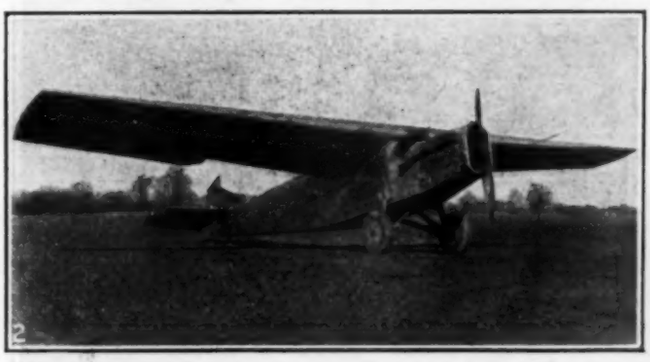

Fig. 2—Stout all-metal plane. Fig. 3—Travel-Air plane in tour

perfect score each leg of the course must be flown in a time not to exceed 50 per cent more than the scheduled time, providing at least 70 per cent of the legs are flown in a time not to exceed 30 per cent above the scheduled time.

If, for example, a leg is 80 miles, the schedule time would be 1 hr. Then 70 per cent of the legs must be flown in not over 1 hr. 18 min., while for the remaining legs of the tour, the time must not exceed 1½ hours.

The trophy is to be competed for only by bona fide manufacturers of commercial airplanes. No army, navy or military plane of any kind will compete. The planes entered must be capable of a speed greater than 80 miles an hour, as loaded for the tour.

All planes entered must seat comfortably, a pilot and a passenger, or in lieu of the passenger, have a cargo space of at least 8 cu.ft. In addition to the pilot, all planes must carry a "pay" load of ½ lb. per cu.in. of engine displacement. This "pay" load may be either passenger or ballast.

Each pilot who completes at least one leg of the tour will receive $100 as an expense allowance, this being paid at the first control station. In addition, each pilot completing the tour within the specified requirements will receive $250 more. The entrance fee of $100 per plane is to be returned when the plane is at the starting line and ready to go at the appointed time. Any pilot found physically unfit during or immediately previous to the tour will be excluded. This includes any who partake of alcoholics in any form.

It is realized that the first tour will be very much of an experiment, so that the trophy will not be awarded this year. Each plane finishing within the requirements, will have the name of the plane and the pilot engraved on the trophy and this will count one leg toward the permanent possession of the trophy. The trophy becomes the permanent property of any manufacturer winning it five times in succession.

The maximum number of ships that may enter this first year's tour, is limited to 36, and a minimum of 4 planes is given as the low limit for the tour to take place. With the interest already shown, however, there is little doubt as to a sufficient number of planes being entered, and started, to insure a fair representation of commercial planes now available in this country.

It is hoped and believed that the landing of these planes in 11 cities of the Middle West, and the fact that the tour is solely for planes used in commercial work, will arouse local interest at many points not on the tour route and result in the establishment of landing fields in other cities and towns.

It is significant to note that the same organization that pioneered the automobile as a vehicle for universal transportation, is alive to the possibilities of the newer methods of travel, and is bending its energies toward making it a commercial success.

The illustrations show something of the Ford Airport, the map of the tour and two commercial planes. The first, Fig. 2, is the Stout all-metal plane, having a span of 58 ft. 8 in., a length of 45 ft. 2 in. and a height of 11 ft. 10 in. The wing area is 618 sq.ft.; the engine is a 400-hp. Liberty; weight of machine empty, 3,717 lb.; useful load 2,152 lb.; maximum speed, 115 m.p.h.—cruising speed 95 m.p.h. and minimum speed 54 m.p.h. The ceiling is 15,000 feet.

The Travel Air, Fig. 3, is a smaller plane in every way. The span is 33 ft.; length 23 ft. 6 in.; height, 8 ft. 6 in., wing area 300 sq.ft.; light weight 1,300 lb.; useful load 750 lb. Motor, Curtiss OX5—90 hp. Maximum speed with this motor, 92 miles per hour; minimum speed 38 miles per hour. The ceiling is 10,000 feet.

Fig. 4—The Ford Airport at Dearborn, Michigan

Fixtures for Machining Shoes and Wedges

A variety of methods used in machining shoes and wedges by different roads—Fixtures are shown both for planing and milling

By Frank C. Hudson

ONE of the changes that has taken place in railway shops is the increasing use of the milling machine for finishing flat surfaces. This is particularly true on work that is fairly long, 12 in. or more, although the exact length varies with the shop and the ideas of the executives. It is also worthy of note that, where the machining cost is given, the new method makes an excellent showing.

Some of the fixtures used by different railroads in machining shoes and wedges are shown herewith. They all show an appreciation of the need for simplicity of design and construction for easy handling, and for machining as many pieces at once as can be handled in the machine used.

The methods used on a well known road are shown in Figs. 1 to 5. Fig. 1 shows a double string of shoes on a planer; Fig. 2 a close-up of two straddle tools for planing the outsides; and Fig. 3 the tools and methods of holding for planing the insides. In Fig. 2 it will be noted that the toolholder has a gap cut to permit the passage of the bolt head between the shoes. The planer is equipped with a pneumatic lift for the tools, as shown in detail in Fig. 4. The details of the tools, Fig. 5, show the holders to be of open-hearth steel and the cutters practically steel "elbows" of high-carbon steel. The parallel strip is used to support a string of shoes.

The milling fixture for shoes, shown in Fig. 6, is simple and can be used for as many shoes as the machine table will accommodate. The end jaw *A* is fixed, while the jaw *B* is permitted to move enough to hold the shoes on each side of it as the block *C* is tightened by the screws shown. In Fig. 7 is shown a fixture for holding shoes when the job is done on a planer.

Another method of holding shoes and wedges is shown in Fig. 8, both a plan and an end view being given. Here the shoes are held against the side of a central casting. Bolts at the ends and between the shoes hold them firmly in place while the inside surfaces are being planed. A fixture somewhat similar to Fig. 7 for holding shoes for planing is shown in Fig. 9, the details being made clear without description.

In Fig. 10 is an entirely different device, being more of a chuck with serrated jaws. As can be seen at *A*,

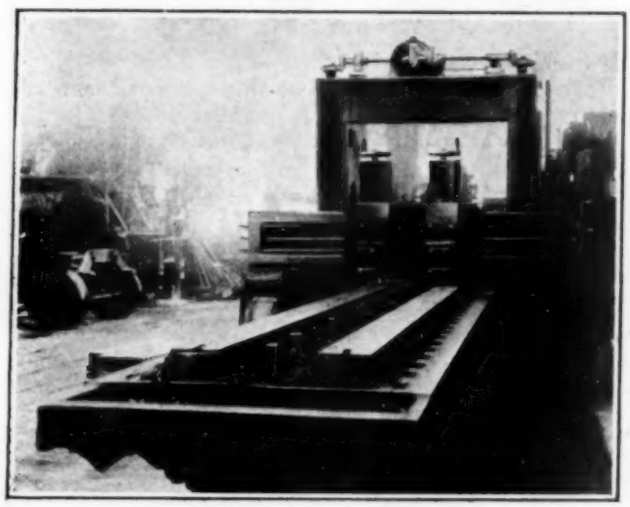

Fig. 1—A double string of wedges

Fig. 2—Straddle planing two rows of shoes

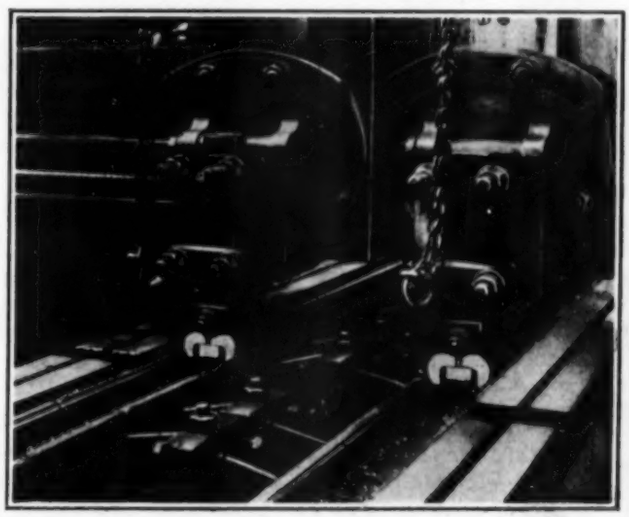

Fig. 3—Planing insides of shoes

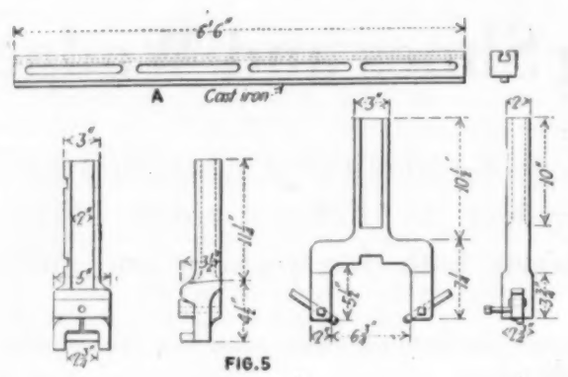

FIG.5

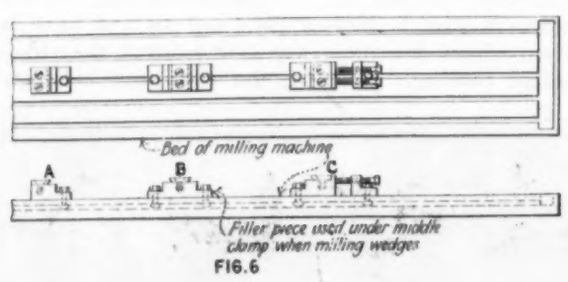

FIG.6

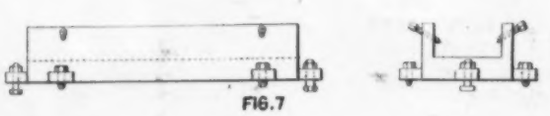
FIG.7

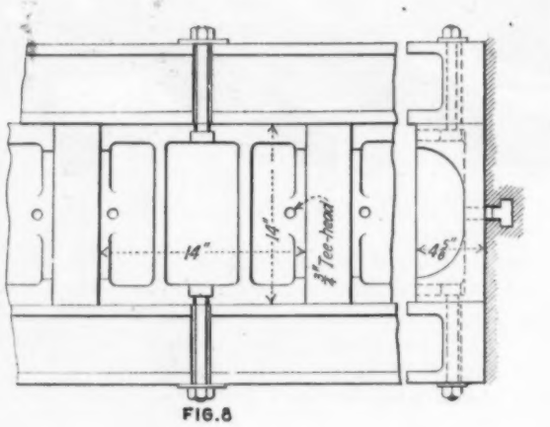

FIG.8

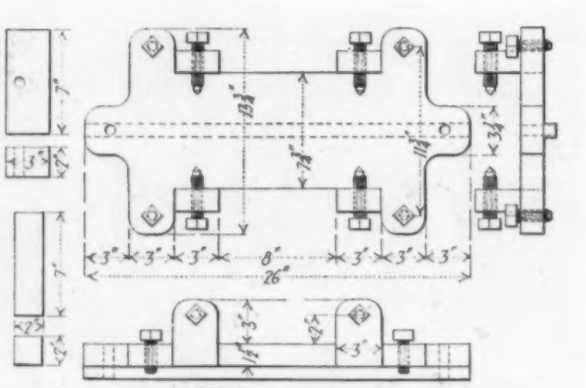

FIG.9

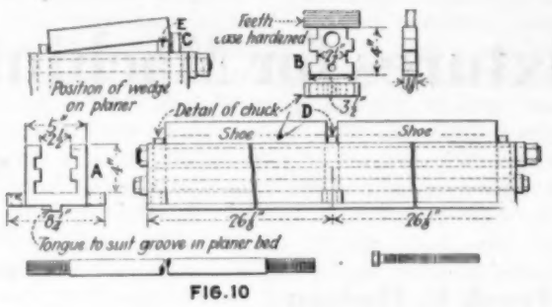

FIG.10

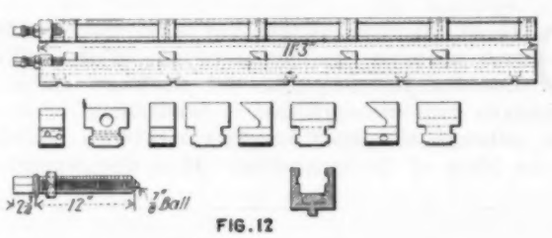

FIG.12

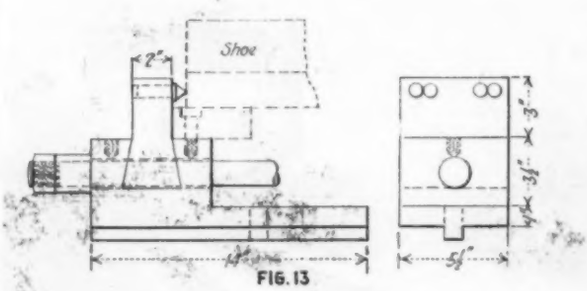

FIG.13

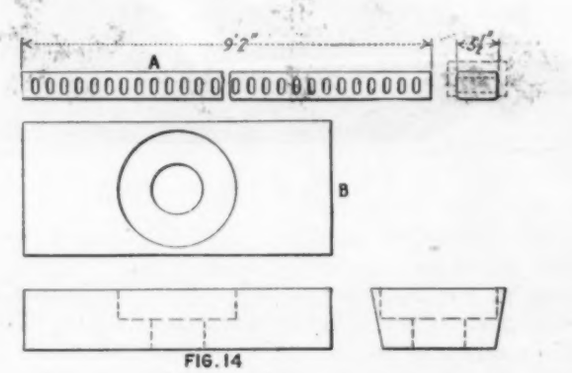

FIG.14

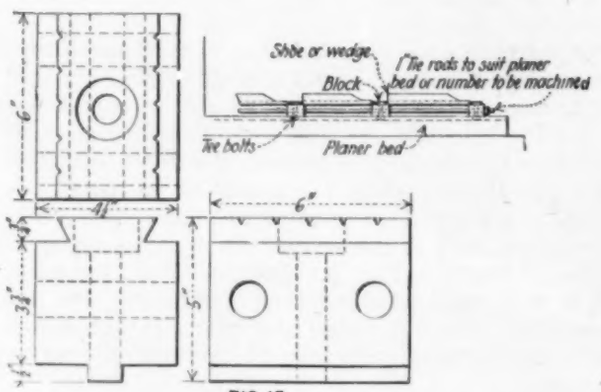

FIG.15

Fig. 5—Details of straddle planing tool. Fig. 6—Multiple fixture for milling shoes and wedges. Fig. 7—Single fixture for planer. Fig. 8—Fixture for planing insides of shoes. Fig. 9—Another single fixture. Fig. 10—Double chuck for planer. Fig. 12—Multiple fixture for milling. Fig. 13—Another method of holding. Fig. 14—Central bar and clamps for shoes. Fig. 15—Clamping fixtures for planer

the body has two slots planed so that the jaw *B* can be in the high position as at *C* when planing wedges, or in the low position as at *D* when planing shoes. The block *E* raises the end of the wedge so as to plane it to the proper taper. The tongues or projections on jaw *B* are turned in a lathe so that the jaw can be turned to insert or remove it from the body of the chuck at any point. By tapping the lower hole in the jaw to suit the long

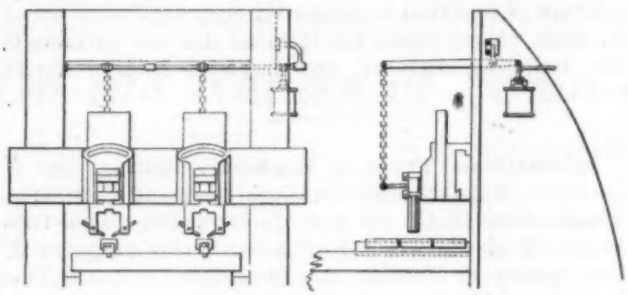

Fig. 4—Pneumatic lift for planer tools

screw, the screw can be used to withdraw the jaw from the work after the nuts on the upper rod are loosened

Fixtures for holding shoes and wedges for milling are shown in Figs. 11 to 13. The set-up in an Ingersoll machine is shown in Fig. 11, while the details of the fixtures are given in Fig. 12. The body or frame is made long enough to hold five shoes or wedges at once, being provided with one fixed jaw at the right and five movable jaws. The four inserted jaws can slide so as to equalize the grip on the shoes or wedges. It will be seen that one edge of the jaw has a plain, angular knife-edge, while the other side has two cone centers, or spurs, that sink into the work. The operation of the fixture is similar to that of those in Figs. 6 and 10. A modification of this fixture is shown in Fig. 13, in the enlarged section.

A modification of some of the methods previously shown can be seen in Fig. 14. The bar, or strip, *A* is cast with a series of slots running from side to side and spaced at center distances of 1¼ in. The shoes go

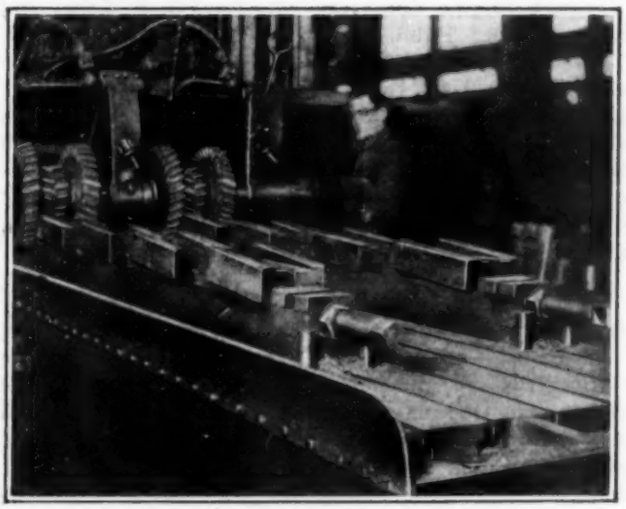

Fig. 11—Milling two rows of wedges

over the bar as shown by the dotted lines. Between each shoe is a clamping wedge *B*, the length being the same as the thickness of the bar. The slots through the bar are 1⅛ in. wide, and by using a ¾ in. bolt there is sufficient leeway to allow the clamps *B* to adjust themselves to the varying lengths of the shoes or wedges to be held. The clamps are counterbored for the bolt heads, so that the sides can be planed at the same setting.

Still another method of holding shoes and wedges is shown in Fig. 15, although the principle is the same as in some of the previous illustrations. The main difference is that no base, or frame, is used, the shoes or wedges resting on the clamping blocks and being fastened by 1-in. rods that go through all of them, drawing the clamping blocks together and holding all that are in the string. The method resembles that shown in Fig. 6, except as to the way in which the clamping jaws are held. Details of the clamping blocks are given in Fig. 15 at the left, the sharp edges with serrations being clearly indicated. This is one of the most simple devices shown and is from a good sized road. Although not shown, it is assumed that the desired taper of wedges is secured by having special clamping blocks of the correct height to hold them at the proper angle.

Oil and Repairs

BY W. EDWARD

There is divided opinion on lubrication for factory equipment as to who should do the actual work. Some hold that each operator should oil his own machine. Others believe that the maintenance department should be responsible. There are merits to both arguments and yet it would seem that the machine operator should be relieved of every possible duty not directly involved in getting production.

Objection to this plan is generally based on two points. One, by the production foreman, is that just as much, or more, time is lost due to the maintenance-department oiler stopping the machinery for oiling during the working periods. The other, which usually comes from the maintenance engineer, is to the effect that he cannot expect first-class results with the type of man he is able to put on the work.

Both objections can be met by the proper approach. Periods for oiling can be timed to occur at intervals between job changes in the machines. Oiling can be done between shifts, before starting in the morning, after the stop at night or at noon time by setting the oilers' hours to suit.

The other point, that of the right man for the job, is not so easily solved, but by presenting the case in all of its aspects, the contention of the maintenance engineer to the management will be met fairly.

An offhand statement that an oiler should be paid on a par with a first-class repair man will not receive favorable comment from the average factory manager.

On the other hand by placing a first-class repair man on oiling and adding a kit of tools to his oiling outfit, a different situation will be produced. There is many a small defect, which can be remedied by the turn of a wrench, that will spell trouble if it is let alone. Many a bearing can be saved if it is caught when it starts to fail. The repair man will see these things as he oils, the act of oiling being in fact a directing finger to points that would ordinarily not be seen.

A first-class repair man as oiler, combined with the duty of taking the stitch in time to obviate the services of nine other repair men, is worth all he can be paid.

Book Reviews

Fundamentals of Business Organization. By Webster Robinson, organization analyst, lecturer in business administration, University of California. Two hundred and thirty pages, 5½x8 in. Published by the McGraw-Hill Book Co., New York City, Price $2.50.

The author in his preface states that the purpose of this volume is to show that regardless of the character or size of a business, there are certain basic factors and relationships that are essential to its effective organization. These fundamental factors are eight in number and are treated in detail.

The first is that there should be definite and stable policies; second, that to have good organization there must be organization of duties; third, the right man should be selected for the right place; fourth, there should be proper direction or planning; fifth and sixth, supervision and control; seventh, he insists on delegation and co-ordination of authority and responsibility; finally, there is the necessity for some wage or position incentive to get the most out of the worker.

The book is designed largely for students of business administration who are becoming numerous in our colleges. It can also be read profitably by managers of plants in order to keep in touch with the latest thought and theories relating to their work.

National Association of Office Managers. Proceedings of the sixth annual conference. One hundred and fourteen pages, 8½x11 in. Paper covers. F. L. Rowland, Secretary, Lincoln National Life Insurance Co., Fort Wayne, Ind. Price $2.

The proceedings of the sixth annual conference of the National Association of Office Managers, held at Akron, Ohio, June 11-13, 1925, have been published. The book contains the addresses made during the course of the conference, two papers read at the convention and reports on the six subjects discussed during the round table conferences in the open forum manner. Addresses that were made at the banquet session are also reported. These subjects included wages, training, efficiency and employees' clubs.

Friction and Lubrication in Machine Building. Edited by Dr. E. Everling from the papers on Reibung und Schmierung im Maschinenbau written by the late Dr.-Ing. L. Gümbel, professor at the Technical Institute of Berlin. Two hundred and thirty-six 7x10-in. pages. Published by M. Krayn, Genthinerstrasse 39, Berlin W. 10. Price 12 marks.

The design of the author is to present a highly technical and complete treatise on the physics of lubrication to meet the requirements of designers of machine bearings. The main problem dealt with in the book is the application of the knowledge of flow, and the theory of hydraulic friction and lubrication in rotating shafts, in practical ways for the design of bearings.

The book is divided into three parts:

I. The theory and operation of friction with and without lubricants.

II. Direct friction of firm bodies.

III. Action of lubricant between surfaces:

A. When the lubricant is forced between the two surfaces by means of the application of external pressure.

B. When the pressure is produced by independent diagonal movement of the bodies.

C. When the pressure is produced through simple sliding motion.

He also discusses the problem of ascertaining the amount of lubricant necessary to allow a vertical valve or similar part to drop a certain distance in a certain time.

Throughout the book the author has worked out the solution of practical problems for each topic with which he deals. Many tables are included that are valuable to the designing engineer, and diagrams help to clarify the text.

International Trade in Machinery Belting. By E. G. Holt. Published by the Department of Commerce, Washington, D. C. 75 pages. Price 15c. This book is No. 22 of the Trade Promotion Series prepared by the Bureau of Foreign and Domestic Commerce and is designed to give comparative statistics and information on American exporting of three classes of belting, rubber, leather and textile in relation to that of other countries. The appendix, for the benefit of those unfamiliar with the processes of belt manufacturing, in a non-technical fashion, discusses the manufacture of the various types of belting.

Copper and Alloys. A 17x22-in. chart prepared and published by Chas. H. Hughes, 2681 Amboy Road, New Dorp, Borough of Richmond, New York, N. Y. price $1.25. The second edition of the chart Copper and Alloys is divided into three sections; the first devoted to copper, the second to its alloys, and the third to data and tables. Short paragraphs discuss the treatment, forms and properties of copper. The compositions of the principal alloys of copper are listed and a table shows the proper alloy for specific purposes. The data tables give the standard sizes and gages for the different forms in which copper and its alloys may be obtained.

A Hot-Wire Anemometer for Measuring Air Flow Through Engine Radiators. By Carl G. F. Zobel and L. B. Carrol. Published by the Bureau of Standards. Technological paper No. 287. Price 5c. The anemometer described by the authors consists of a grid of platinum wires heated by an electric current from a storage battery. The flow of air cools the wires and the amount of electricity necessary to maintain them at a definite temperature serves to measure the velocity of air flow. The authors relate their experiments which gave measurements accurate within 5 per cent.

Standards of the Hydraulic Society. Published by the Hydraulic Society, 90 West St., New York, N. Y. This 34-page book, 6x9 in., is the third edition of the "Standards" recommended by the society. It contains the information embraced in the previous editions and new data such as a standard classification of pumps, standard nomenclature and definitions pertaining to the industry, standard dimensions for cast-iron flanged reducers for 125-lb. and 250-lb. steam pressures, and a complete list of chemicals and other special liquids, specifying the materials recommended in the construction of pumps for handling these special liquids. The information contained is both interesting and valuable from a practical standpoint.

Abstracts of Steel Treaters' Papers

These papers were presented September 14-18 at the Cleveland meeting of the American Society for Steel Treating

On the Nature of Some Low-Tungsten Tool Steels

By M. A. Grossmann* and E. C. Bain†

THE steels under present consideration are low-tungsten tool steels, of the types used when demanding of cutting tools, a moderate increase of efficiency over plain, carbon steels. They are frequently called "finishing steels" and contain about 3.00 per cent tungsten and somewhat over 1.00 per cent carbon.

The steels tested were of two types—one "oil-hardening," the other "water-hardening":

	Steel No. I. Oil-hardening Per Cent	Steel No. II. Water-hardening Per Cent
C	1.08	1.23
Mn	0.35	0.25
Si	0.36	0.14
W	2.66	2.46
Cr	0.50	0.14
V	0.29	nil

The most pronounced feature is the expansion which sets in at about 400 deg. F. and which has a maximum at between 450 and 550 deg. F. This expansion is presumed to be due to the breaking down of austenite, and this presumption may be considered to have received adequate proof in recent years. Since it begins to be decomposed at 400 deg. F., the austenite is of a low degree of stability.

Upon heating a little higher, more of the austenite is decomposed, and the process continues until it has all been decomposed at about 800 deg. F. It should be borne in mind that the net change in length after any heating in this range is the algebraic sum of three possible effects: 1.—the original martensite continues to break down and contract; 2.—The austenite is transformed to alpha iron and expands; 3.—the latter, newly formed, alpha iron with its carbides undergoes contractions similar to the martensite change. If we find, then, that heating leads to expansion, for example, between 400 and 450 deg. F., it means that the expansion due to transformation of austenite is the predominating reaction. But if we find that contraction is taking place, as in the range from 600 to 650 deg. F., we cannot conclude that all the austenite is decomposed, we can merely say that the contractile effects due to formation of carbides and to grain growth, are having a more pronounced influence on the total volume of the steel, than is the expansion due to decomposition of any remaining austenite. There is good evidence that in this higher tempering range, there is still considerable austenite, but it is in the minority in effecting volume changes.

When the quenching temperature is raised somewhat, the amount of austenite retained in the quench increases, as indicated by the greater total expansion, when the austenite transforms to alpha iron. The amount of retained austenite reaches a maximum when the quenching temperature is about 1,800 deg. F. When the steel is heated beyond that temperature, the amount of this relatively unstable austenite no longer increases —it actually begins to decrease.

As the quenching temperature is raised, the greater retention of austenite leads to two phenomena: a.—the steel is softer in the "as-quenched" condition, and b.—there is found an increasing secondary hardness at 500 deg. F. Both of these phenomena can be attributed to the retained austenite. The austenite is softer than the martensite and causes the initial softness, and the secondary hardness at 500 deg. F. would, naturally, increase when the austenite, which is responsible for it, increases in amount. This marked increase in hardness at the low drawing temperature is unusual.

The Reason for Hardness

A manganese steel, with an equivalent amount of austenite retained in the quench, exhibits practically no rise in hardness when the austenite is transformed at this low temperature. Other low-alloy steels, with lesser amounts of austenite, will, of course, exhibit almost no change in hardness. The increase in hardness of these low tungsten steels is paralleled only by the secondary hardness of high-tungsten or high-chromium steels after a high quench, but in these cases the secondary hardness appears on drawing at 1,100 deg. F., and not at 500 deg. F. Presumably the great secondary hardness in the present steels is due, first, to the very large amount of austenite (as shown in the pronounced expansion) and, second, to a certain stability and hardness of the products of transformation of the austenite, due to the presence of tungsten and chromium.

Obtaining Toughness Values

The oil-hardening steel was further tested for impact toughness in a machine of the Charpy type. Unnotched bars, ⅜ in. sq. and 2¼ in. long, were tested in various conditions of heat-treatment. One series was quenched at 1,600 deg. F., one at 1,700 deg. F., and one at 1,900 deg. F., and pieces from each series were tempered at a series of successively higher temperatures. The toughness values obtained did not exhibit as satisfactory concordance as would be desired, but the averages from a number of tests showed very definite trends. These trends accord in every respect with the other phenomena and the deductions therefrom, as outlined

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above. The first change in the quenched specimens, in tempering them up to 400 deg. F., is a decomposition of the martensite which was present after the quench. This results in contraction, softening, and in an increase in toughness. In the range from 400 to 500 deg. F., most of the less stable austenite is decomposed, forming very fine-grained alpha iron with highly dispersed carbon or carbides. This shows in the expansion and in the increase in hardness. It is accompanied also by the development of a certain amount of brittleness. When the tempering temperature is raised beyond this point, the association of carbides proceeds, together with grain growth, and results in contraction, decrease in hardness, and pronounced increase in toughness.

In comparing the two steels, Nos. 1 and 2, the explanation of the difference in hardening must be sought in the composition. The significant differences are in the chromium, the vanadium and the silicon, and of these the chromium, and to a lesser extent the vanadium, are, without doubt, the causes for the increased response to heat-treatment. It has long been held that chromium increases the solubility of tungsten in carbon steels. Assuming the correctness of this view, it is readily understood that the availability of tungsten atoms for the formation of regions of austenite would be much greater in the steels containing chromium. During all the hot-working processes the chromium would make for diffusion of the tungsten atoms, and in the heating for hardening would lead to a similar diffusion. This would result in the formation of a more "concentrated" austenite, with more of the tungsten atoms and, incidentally, more carbon atoms also. This would lead to more stability of the austenite in cooling, and added to this would be the increase in stability due to the presence of chromium in the austenite. The austenite of Steel No. 1 would, thus, be comparatively quite stable.

The effect of the greater availability of tungsten atoms is in evidence also in the formation of the more stable austenite, which decomposes only upon tempering at 1,100 deg. F. It is probable that there are different regions throughout the steel, some of them consisting of austenite of lesser stability, and others (richer in tungsten) consisting of austenite of greater stability. These different regions are, undoubtedly, contiguous, and result from the accidental positions of masses of available tungsten atoms. Concentration gradients arise in the diffusion from these concentrated regions into the poorer regions while the steel is in the heated gamma-iron condition, and at the moment of quenching, there are regions of different degrees of richness and, hence, of different degrees of stability.

The Chemical Composition of Tool Steels

By J. P. Gill* and M. A. Frost†

THERE are about 250 brands of high-speed, alloy and carbon tool steels used in this country which have a fairly wide application. There are, probably, from 300 to 600 additional brands that have a limited use. Excepting the carbon tool steels, there is a wide variation in composition between many of these different brands, representing the same general type and recommended for the same purposes. The simplest type is a straight-carbon tool steel and in Table I is given the chemical composition of a number of steels of this type.

Chromium and tungsten should be limited to a total of 0.10 per cent in carbon tool steels for many purposes, as either element increases the depth of hardening.

If a user wishes a greater depth of hardness than obtainable from a straight-carbon tool steel, he should specify a light alloy steel. Nickel is highly detrimental to carbon tool steel—even in small amounts; and it is an element that is today likely to be found in at least small amounts in nearly all steel scrap. Copper has an embrittling effect (chiefly hot shortness) on carbon tool steels, not noticeable in amounts as small as 0.05 per cent.

Table I—Carbon Tool Steels

No.	C	Si	Mn	S, Max.[1]	P, Max.	Cr, Max.	W, Max.	Ni, Max.
1	not	0.10/0.25	0.20/0.30	0.02	0.02	....	....	....
2	spec.	0.10/0.30	0.20/0.35	0.035	0.035	....	....	....
3	....	0.15/0.25	0.20/0.30	0.02	0.02	0.05	....	....
4	....	0.15/0.30	0.25/0.40	0.03	0.03	0.05	....	....
5	....	0.20/0.35	0.10/0.30	0.03	0.03	0.05	0.05	0.05

[1]Max. infers that no per cent of this element is desirable.

In Table II are the so-called non-deforming, oil-hardening steels of the manganese type. In Table III are given several analyses of high-carbon, low-tungsten finishing steels as made by different manufacturers.

Table II—Non-Deforming, Oil-Hardening Steels

No.	C	Mn	Si, Max.	S, Max.	P, Max.	Cr.	W	V
1	0.85	1.15	0.15	0.025	0.025	0.55	....	....
2	0.86	1.45	0.20	0.025	0.025	....	....	....
3	0.98	0.90	0.30	0.025	0.025	0.75	....	....
4	0.95	1.65	0.33	0.025	0.025	....	....	....
5	0.80	1.01	0.34	0.025	0.025	0.40	0.40	....
6	0.90	1.50	0.25	0.025	0.025	....	....	0.25
7	0.95	1.10	0.20	0.025	0.025	0.50	0.50	0.20

This class of steels should not be confused with the steels of similar carbon analyses having a carbon content of about 0.50 per cent which is a punch and chisel steel, or with steels having a slightly higher carbon content, with from 2 to 5 per cent tungsten and used almost exclusively for drawing dies. Steels of this type will withstand more wear or abrasion than straight-carbon steels; they impart a very smooth finishing cut to cast iron, steel or brass, and are non-deforming when oil-hardened, in which case they are less brittle than manganese non-deforming steel.

The three types of steel so far discussed are all basically cutting steels and are used almost wholly in operations involving the cutting and shaping of cold metals. The next group is, as a whole, used for a totally different purpose; that of cutting and shaping hot metals. This group, which is termed the hot-working die steels, divides itself into three general types. These are the low-carbon, high-alloy, the high-carbon chromium and the low-carbon, low-alloy types.

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In Table IV, type A, the low-carbon, high-alloy type, is, of course, oil- or air-hardening. It cannot be hardened file hard in regular heat-treating practice. It will withstand the highest heat of the three types without failure, and also shows the best wearing qualities. It will not withstand a great amount of shock and cannot be cooled in operation with a stream of water without considerable breakage.

Table III—High-Carbon, Low-Tungsten Finishing Steels

No.	C	Si	Mn	S, Max.	P, Max.	W	Cr	V
1	1.12	0.40	0.25	0.025	0.025	1.40	0.50	0.20
2	1.20	0.20	0.35	0.025	0.025	1.65	0.50	0.25
3	1.00	0.19	0.26	0.025	0.025	1.50	....	0.12
4	1.00	0.14	0.12	0.025	0.025	0.60	....	....
5	1.23	0.20	0.20	0.025	0.025	2.68	0.62	....
6	1.25	0.20	0.25	0.025	0.025	1.35	0.42	0.18
7	1.10	0.21	0.26	0.025	0.025	1.05	....	....
8	1.10	0.20	0.23	0.025	0.025	2.25	....	....
9	1.15	0.30	0.20	0.025	0.025	1.60	0.42	0.20

Type B is the high-carbon, chromium type, so widely used for gripper dies in bolt and rivet plants. It is usually hardened by cooling in air, although oil quenching is, at times, used. The steels listed under type C are of the low-carbon, low-alloy type, and although used for hot-working, actually have a much wider usage in other fields. They are usually hardened by quenching in oil. They are very tough and will withstand a heavy shock without breakage. They can be safely water-cooled in use. In the hot-working field they are used for heading square-head bolts and for special forging dies.

Table IV—Hot-Working Die Steels

No.	C	Si	Mn	S, Max.	P, Max.	W	Cr	V	Ni
A-1	0.46	0.20	0.20	0.025	0.025	11.00	1.50	....	....
A-2	0.33	0.30	0.20	0.025	0.025	9.50	3.30	0.40	....
A-3	0.35	0.30	0.20	0.025	0.025	10.50	3.25	0.50	....
B-1	0.87	0.45	0.40	0.025	0.025	.....	3.75	....	....
B-2	0.90	0.20	0.40	0.025	0.025	.....	3.25	....	....
B-3	0.90	0.20	0.34	0.025	0.025	.....	4.10	....	....
B-4	0.95	0.30	0.20	0.025	0.025	.....	3.90	....	....
C-1	0.46	0.23	0.30	0.025	0.025	2.25	1.24	0.26	....
C-2	0.55	0.24	0.60	0.025	0.025	.....	1.00	0.30	....
C-3	0.60	0.22	0.35	0.025	0.025	1.61	0.75	....	....
C-4	0.42	0.10	0.53	0.025	0.025	.....	1.05	....	3.59
C-5	0.46	0.18	0.22	0.025	0.025	1.02	1.80	....	....
C-6	0.50	1.13	0.26	0.025	0.025	1.25	0.90	....	....
C-7	0.50	0.30	0.20	0.025	0.025	2.00	1.65	0.25	....

Table V has been compiled of the high-carbon, high-chromium type steel, which is widely used for cold-drawing dies. All of the steels shown in this table are used and manufactured in this country today.

One other class of steels remains to be discussed, that of high-speed steel. This type of steel, because of its high alloy content and the large number of alloys that may enter into its make-up, permits the widest variation in chemical composition; yet over 95 per cent of all high-speed steel used in this country is of the three general types shown in Table VI, and of this over 80 per cent is of the 18-per cent tungsten, 4-per cent chromium, 1-per cent vanadium type.

The steels with the carbon on the low side are noticeably tougher than those with carbon on the high side. Also, the lower carbon steels cannot be hardened as hard as the higher carbon. The carbon content in high-speed steel is of the utmost importance and often represents the difference between good and poor performance. The silicon content is usually around 0.25 to 0.30 per cent and there are no detrimental effects noticeable even at 0.40 per cent. Above this the opinion is that it will cause a small amount of brittleness. The manganese is also usually from 0.25 to 0.30 per cent. Over 0.40 per cent, there may result brittleness.

A tungsten content of 18.00 per cent for type A, is what most manufacturers desire. Going above 18.00 per cent tungsten, may offer some slight advantage in wearing qualities which is more than offset by increased brittleness. Going below 18.00 per cent, lessens the cutting and wearing ability of the steel, although there is some slight increase in toughness. As to the chromium content, about 4.00 per cent imparts sufficient hardness both directly and in permitting a greater solubility of the tungsten. Going below 4.00 per cent the steel is less hard, so that at 3.00 per cent there is a very noticeable difference. Going above 4.00 per cent causes brittleness which becomes very noticeable at about 5.00 per cent. As to vanadium content, the majority of the manufacturers seem to agree that it is best to work to about 1.00 per cent, but as vanadium is worth some $3.50 per pound, there is a tendency to shade this amount and actually add about 0.80 per cent.

Table V—High-Carbon, High-Chromium Steels

No.	C	Si	Mn	S	P	W	Cr	V	Co	Mn	Ni
1	2.20	0.25	0.25	.....	.....	.....	11.00	....	....	....	....
2	1.77	0.63	0.65	0.005	0.024	9.08	1.43	....	....	....	....
3	2.45	0.20	0.52	0.011	0.028	.....	13.76	....	....	....	1.05
4	1.67	0.35	0.18	0.008	0.039	.....	10.40	....	3.01	0.61	0.93
5	2.50	0.06	0.49	0.013	0.018	.....	12.78	....	....	....	....
6	1.45	0.32	0.33	.....	.....	.....	19.40	....	....	....	....
7	2.26	0.10	0.29	0.007	0.020	.....	13.38	....	....	....	....
8	2.88	....	....	.....	.....	.....	14.80	0.50	....	....	....
9	2.06	0.32	0.14	0.027	0.011	.....	12.29	1.16	....	....	....

The other elements that are sometimes found in small amounts in type A steels are molybdenum and uranium. Molybdenum has about the same effect as tungsten, except that molybdenum is from two to two and a half times as potent. About 8.00 per cent molybdenum will, therefore, impart about the same properties to high-speed steel as 18.00 per cent tungsten, except that the molybdenum steel will be tougher. Molybdenum cannot, however, be used in amounts much in excess of 1.00 per cent without causing a surface softness, and this characteristic has prevented its more general use, especially in larger amounts. Uranium seems to offer no advantages in small amounts, and if even as little as 0.30 per cent did give some beneficial results, they would be more than offset by the increased dirtiness of the steel resulting from the heavy uranium oxides which remain suspended in the steel and weaken its structure.

Table VI—High Speed Steels

Steel No.	C	Si	Mn	S, Max.	P, Max.	W	Cr	V	Mo	Co	Ur
A-1	0.60/0.75	0.30	0.25	0.025	0.025	18.50	4.00	0.85	....	....	0.30
A-2	0.60/0.75	0.30	0.25	0.025	0.025	18.25	4.00	1.00	....	....	....
A-3	0.60/0.75	0.20	0.05	0.025	0.025	17.60	3.20	0.70	....	....	....
A-4	0.60/0.75	0.20	0.25	0.025	0.025	18.00	4.20	0.60	....	....	....
A-5	0.60/0.75	0.20	0.25	0.025	0.025	17.75	4.00	1.05	....	....	....
A-6	0.60/0.75	0.20	0.25	0.025	0.025	20.25	4.25	1.48	0.50	....	....
A-7	0.60/0.75	0.20	0.25	0.025	0.025	18.00	3.15	0.85	0.24	....	....
A-8	0.60/0.75	0.20	0.25	0.025	0.025	21.00	4.00	1.10	....	....	....
A-9	0.60/0.75	0.20	0.25	0.025	0.025	18.00	4.00	1.00	....	....	....
B-1	0.60/0.75	0.25	0.25	0.025	0.025	13.50	4.00	1.65	....	....	....
B-2	0.60/0.75	0.25	0.25	0.025	0.025	13.75	4.50	1.40	....	....	....
B-3	0.60/0.75	0.25	0.25	0.025	0.025	14.00	4.25	2.05	....	....	....
C-1	0.60/0.75	0.25	0.25	0.025	0.025	17.50	4.00	1.00	....	3.00	....
C-2	0.60/0.75	0.25	0.25	0.025	0.025	17.50	4.00	1.00	....	4.50	....
C-3	0.60/0.75	0.25	0.25	0.025	0.025	17.50	4.00	1.00	0.75	4.50	....
C-4	0.60/0.75	0.25	0.25	0.025	0.025	16.00	2.75	0.90	1.00	4.00	0.20

steel is to compare favorably with the 18-4-1 type, the vanadium content should be above 1.60 per cent. As to the relative merits between the 18.00 per cent tungsten, 4.00 per cent chromium, 1.00 per cent vanadium type, and 14.00 per cent tungsten, 4.00 per cent chromium, 2.00 per cent vanadium type, there is considerable difference of opinion. The lower tungsten type can be hardened from a lower temperature, but can be more readily overheated. It is more sensitive to heat-treatment. Although the 14-4-2 type has been on the market for some years and is made by a number of different manufacturers, it has made little inroad in replacing the 18-4-1 type.

The cobalt, high-speed steels designated as type C, contain from 3.00 to 5.00 per cent cobalt, and may contain about 1.00 per cent molybdenum, and in one steel both molybdenum and uranium. The other elements being the same, 4.50 per cent cobalt is better than 3.00 per cent, but as the cobalt content increases above 5.00 per cent, the steel will harden less, so that at some 6.00 or 7.00 per cent cobalt, the steel fails to respond fully to heat treatment. Cobalt seems to increase the temperature at which failure of the cutting edge will take place and also gives better wearing qualities. It slightly increases the brittleness of the steel. Cobalt causes the steel to harden with a soft skin, which must be removed before using. Because of this characteristic the steel has been limited in its use to such tools, as lathe, planer, shaper, cut-off and boring tools, which can be ground after hardening. This type steel has proved its worth where it can be used. The addition of small amounts of molybdenum increases its wearing quality.

Small amounts of arsenic, antimony, tin and copper are likely to be found in high-speed steels in varying amounts, since these elements contaminate nearly all foreign, tungsten ores. These elements, more particularly arsenic and antimony, cause both hot and cold shortness, and are often times the cause of unusual brittleness in high-speed steels.

What Happens When Metal Fails by "Fatigue"?

By H. F. Moore*

TO THE question, "What holds the particles of solids together?," the physicist has as yet given no very clear answer. Some physicists picture a balance between attracting and repelling forces which keep the atoms arranged in a certain definite pattern, but for the present we will have to be satisfied with the general statement that there exists in solids a property called "cohesion," by virtue of which, the particles of a solid tend to stick together, and resist being forced apart.

When the metallurgical microscope came into general use, it at once became evident that metals which had been considered to be homogeneous to a high degree, were not homogeneous, but rather were made up of an aggregation of irregular crystalline grains—some weak, some strong, some so placed as to offer strong resistance to internal forces in one direction and little resistance to internal forces in another direction.

Theory Not a Basis

The first thought of an engineer on seeing through a microscope the crystalline structure of a metal, is likely to be that the foundations of the whole theory of elasticity as applied to actual metals are washed away, and that he may as well throw overboard all his formulas for shafts, beams, columns, and tierods. As a matter of fact the case is not nearly so serious as that, but the fact remains that the theory of elasticity can no longer be regarded as furnishing a *complete* basis for figuring the strength of structural and machine parts.

Under physical test, the crystalline grains become slightly serrated at the edges, and possibly this serration offers increased resistance to the motion of a crystal with reference to other crystals.

If, however, instead of a single force, there act on the crystal a succession of forces, acting first one way, then the reverse way, then the serrated edges of the crystals and the roughened surfaces of the laminæ may be pictured as acting as minute files, each "file" tearing loose projecting particles on adjacent crystals and laminæ, and occasionally losing some of its own "teeth" in the process. The result of this filing action is that minute cavities (cracks) start and spread.

The net result of slip in a metal may then be pictured as the balance between two actions, one beneficial, and one destructive; one an increase in resistance to further slip, that is, a gain in strength; and the other a gradual "filing" action tending to start and spread minute cracks in the metal. If the internal force in the metal (stress) is low, a slipping within a few "unfortunate" crystalline grains occurs, but the increased resistance to further slip in these grains throws the stress to other grains, and a readjustment occurs without much destructive "filing" action, and as a result of the whole action, the metal is stronger than it was at first.

If the repeated stress is very high the slipping action affects many more crystalline grains, and instead of dying out after a few thousand cycles of stress, the destructive "filing" action keeps up until there is formed a crack, visible under the microscope, or sometimes visible to the unaided eye.

Cracks Mean Fatigue

In steel there are two kinds of grains, one stronger than the other, and a crack in a weak grain may be stopped by a strong grain, especially in fine-grained steel. Usually, however, when a crack becomes visible to the unaided eye, fatigue failure is not far off, although the writer has observed cases in which a crack could be detected when only half the "life" of the test specimen had been passed. The spread of a crack diminishes the amount of sound metal left to carry the load, and finally the net cross-section is so reduced that static failure occurs. The failure is so confined to the plane of the crack, that the elongation developed is usually negligible.

For most metals, tests indicate what is known as an

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endurance limit—a critical stress below which the metal will withstand an indefinitely large number of cycles of stress without failure. At the endurance limit, the beneficial influence of the strengthening action, due to roughened laminæ and serrated edges of crystalline grain, just balances the injurious action due to the "filing" action under repeated stress.

The above crude picture of the action of metal under repeated stress, seems useful in explaining the observed properties of cold-worked metals. If steel of about 0.20-per cent carbon content is cold-worked by drawing through dies, or by rolling, its resistance to further slip under a given load (elastic strength) is greatly increased, and its resistance to repeated stress is increased slightly. If the same steel is cold-worked by being pulled in a testing machine, its elastic strength is increased, but its resistance to repeated stress is lowered. In both cases the cold working seems to increase the resistance to further slip under any one load, but the transverse compressive action of dies or rolls seems to pack the crystalline grains tightly together, to lessen the formation of minute fissures, and to prevent some of the "filing" action which accompanies even a single, large slip, such as was caused by cold working by direct tension in a testing machine. Possibly the polished surface produced in commercial cold-drawing or cold-rolling may also be a strengthening factor.

For non-ferrous metals, it has been found that the effect of cold working on the elastic strength is even greater than in the case of ferrous metals, but that the destructive effect of slip is still greater, and that cold-rolling or cold-drawing raises the endurance limit of non-ferrous metal, little, if at all. The results obtained by the use of the ordinary formulas are as "statistically" true as are the results obtained by life insurance actuaries from tables of average mortality. For static loading this means that the ordinary formulas may be regarded as practically exact, and that small localized stresses may be disregarded, except for very brittle material. For repeated-stress problems, the ordinary formulas are, for most cases, serviceable.

For studying the tendency to develop a crack at such places as the bottom of a screw thread, where the area considered may be only one crystal wide, the inexactness of either the ordinary formulas or of the more elaborate formulas of the theory of elasticity, begins to show up. The ordinary formulas for beams and shafts, neglect many localized stresses and some of these stresses may be two or three times as high as the stresses ordinarily computed. These stresses may become "effective" under repeated stress, by causing the start of spreading cracks. One interesting fact, however, is brought out by fatigue tests on pieces with sharp notches, that in all cases so far studied, the careful formulas of the theory of elasticity give results on the *safe* side. We can still use our ordinary formulas for beams, shafts, etc., but must remember that they neglect many cases of high localized stress, which may cause failure under repeated load. We can use the elaborate formulas of the theory of elasticity (or, what is the same thing, the results of stress analysis by the use of celluloid models and polarized light) and be reasonably sure that our results are on the safe side.

Irregular Carburization of Iron and Iron Alloys—The Cause and Prevention

By W. J. Merten*

ALL carburizers, whether solid, liquid, or gaseous, contain carbon as a base. The usual carbon bases for solid carburizers are charcoal, petroleum coke, charred leather, etc. These substances are compounded with alkaline carbonates, or cyanides, the so-called energizers.

Sodium, barium, and calcium carbonates are the commonly employed energizers. Pure sodium and barium carbonates, plus charcoal, requiring a high temperature for calcining or freeing of CO_2 from the carbonate, $BaCO_3$ at 2,010 deg. F. (1,100 deg. C.) yields $BaO + CO_2$ and $CaCO_3$ at 1,290 deg. F. (700 deg. C.) yields $CaO + CO_2$ and Na_2CO_3 at 1,830 deg. F. (1,000 deg. C.) yields $Na_2O + CO_2$. Calcium carbonate ($CaCO_3$) has the lowest heat of dissociation of the three mentioned.

Magnesium carbonate ($MgCO_3$), although not used as commonly, has considerable advantage, and even at as low a temperature as 100 deg. C., will start to decompose and cannot, therefore, be entirely dehydrated. Its quantity of heat of dissociation is 60,863 calories at 1,006 deg. F. (540.8 deg. C.) and at 747 mm. pressure, yields all of its CO_2, or decomposes entirely. Its chief advantage lies in the readiness with which it is dissociated, partial dissociation starting at low temperatures. Sodium and barium carbonates are more stable, and when heated singly do not give up their CO_2 until a temperature of 1,800 deg. F. (1,000 deg. C.) or more is reached, which temperature is practically out of the range where carburizing is conducted. A lowering of the heat of dissociation of sodium and barium carbonates, so as to give up their CO_2 at carburizing heat, is affected by mixing them with calcium or magnesium carbonates. Even the mixing of the two stable salts seems to bring a lowering of the calcining heat. The reactions necessary for cementation, are the freeing of CO_2, or production of CO_2 from the energizers, and the interaction of CO_2 with incandescent carbon forming CO, which interacts with iron to form iron carbide and CO_2.

To form carbon monoxide (CO) from carbon dioxide, (CO_2) incandescant carbon at a temperature not less than 1,470 deg. F. (800 deg. C.) is necessary. Carbon dioxide (CO_2) produced at a low temperature from Mg CO_2 can and does produce unfavorable atmospheric conditions within the container, and in presence of moisture may become intensely oxidizing or corrosive in action, thereby retarding the process, since the reduction of the oxide must necessarily precede the cementation reaction. Due to this fact, Mg CO_2 ordinarily is not used alone, but is mixed with a more refractory carbonate, such as barium carbonate (Ba CO_3). If,

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however, CO_2 as produced from Mg CO_3 at a low temperature, is passed through a bed of charcoal at red heat of approximately 900 deg. C. to form CO, and the CO formed is brought into contact with iron held at the carburizing heat, satisfactory and high grade carburizing can be accomplished.

The presence of hydrogen or hyrocarbons as binders, or moisture (water vapor), or water of crystallization, have a decided accelerating effect upon the carburizing process, and when present are the main factors to produce a hyper-euctectoid case. CH_4 is the most noteworthy one of the hydrocarbons in this respect, and apparently a sufficient quantity of this gas is evolved around 1,100 deg. F. to produce a carburizing atmosphere and a carburizing reaction, providing the iron is chemically active to form Fe_3C. This, however, is not particularly in keeping with our most recent investigation of the properties of alpha iron; alpha iron does not hold carbon or iron carbide (Fe_3C) in solid solution, and chemical reaction between alpha iron and CO at temperatures below 1,400 deg. F. (760 deg. C.) is also rather questionable.

Steel generally used for carburizing, is a low-carbon, open-hearth steel containing from 0.15 to 0.25 per cent carbon, although electric-furnace and Bessemer-converter steels are at times used. Articles or parts for carburizing are generally made of hot-rolled steel, drop forgings, or hot-pressed parts. In special and infrequent cases, cast-steel parts are carburized. It is common practice to machine and then carburize the parts without even giving them an anneal after the hot working.

Scale Often Helps

It is not considered necessary to have the steel parts entirely free from scale (Fe_3O_4), and especially on drop-forged parts, scaled parts or areas are sometimes considered an advantage, since they offer protection against carburizing of these areas. Considering the chemical reactions of scale and carbon, the speed of reaction on the steel is reduced and the efficiency of the carburizing process is lowered, both as to time and character of case, and causes the disturbances in the cementation reaction. It becomes evident that oxide scale, Fe_3O_4, is of a deleterious character in a carburizing container, and should be removed before the steel is subjected to this process. This same reasoning must be applied to protective layers and coatings of cement for selective cementation, most of them being of an oxide character, which introduce disturbing elements into the carburizing container. They are chemically active at carburizing temperatures where inert conditions of such protective coatings are essential. Even copper-plated parts are not free from this objection on account of oxide inclusions and contamination of the electrodeposit. Pure solid copper bodies placed against or around parts to be left soft, serve a better positive means for such practice.

Carburizing after casting, without heat-treatment to break up the cast structure or the so-called structure of primary crystallization or dendritic structure, is objectionable, and any test for carburizing on chilled cast bars or any cast test-bar ingot, cannot be a criterion of the quality of that steel for cementation or carburizing.

Packing the parts into the container, ordinarily involves covering the bottom with carburizing compound to a thickness of probably 1 in., with spacings of approximately 1 in. between the individual pieces, and filling carburizing compound between them. Naturally, gas evolution and chemical reaction between gas and steel is not especially favored by surface contact of carbon with steel. Still more unfavorable conditions become prevalent when the carburizing material becomes pulverized and actually shrouds the steel from contact with the gases. Consequently unsatisfactory progress of carburizing ensues. A still greater menace is the fusible ash residue, consisting of a fusion of the small amount of silicious ash and alkali carbonates in the carburizers, forming a silicate slag, which is the cause of pitting and surface scoring of the steel, resulting in decarburization and inter-granular attack of the steel in the surface layers.

The amount of CO gas present has a great influence upon the reaction between CO and Fe. If the ratio of the CO to the Fe is large, the reaction pressure seems to be much greater than when smaller amounts of CO gas are present. Since, by action of CO on Fe, we form Fe_3C, at temperatures above 1,290 deg. F., (700 deg. C.) the Fe_3C will go into solid solution with iron. If CO gas is not predominant, and large amounts of CO_2 gas are in evidence, further oxidation of Fe_3C will take place.

It becomes evident that a purely gas-pressure, contact-carburizing is the desirable process for quality results. To obtain this in the old style carburizing boxes and without radically changing the old process, a series of copper screens was made which kept the solid carburizing compound from coming in contact with the parts and permitted the suspension of the parts. Spacing and packing were no longer necessary and a simple filling of the carburizer around the screened part was the only care expected of the operator. The improvements in the uniformity and depth of case were at once manifest and a greater concentration of carbide was procured.

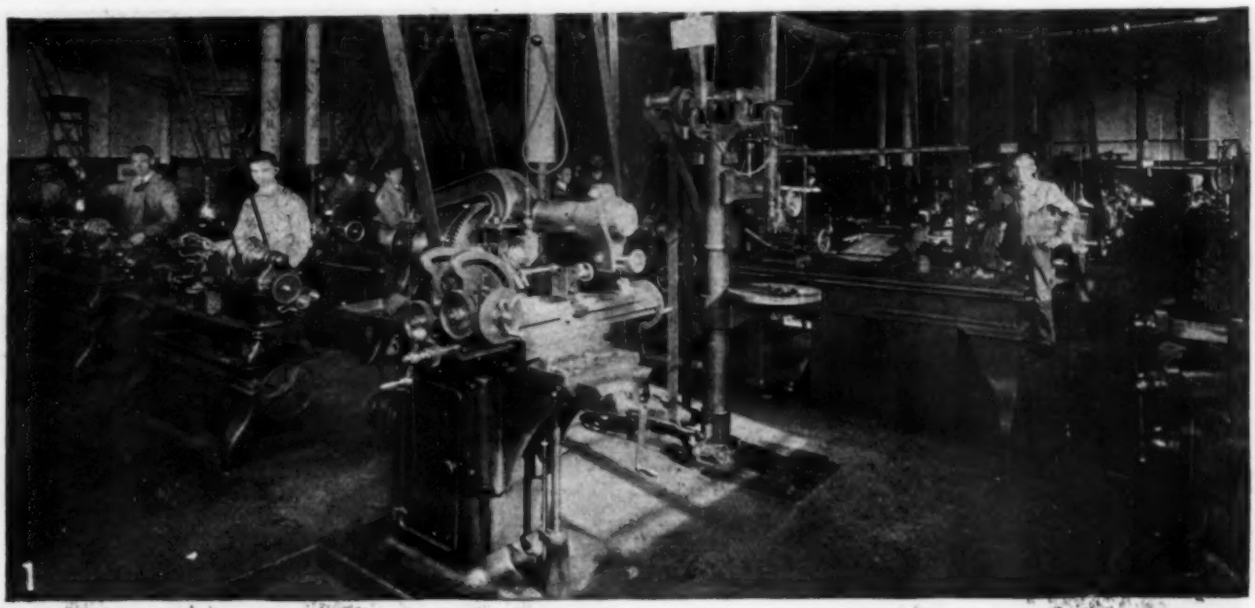
The surfaces of the parts treated were lustrous and bright, where formerly discoloration was obtained. Low- and medium-carbon steels all react in the same manner and respond readily to the action of the CO gas.

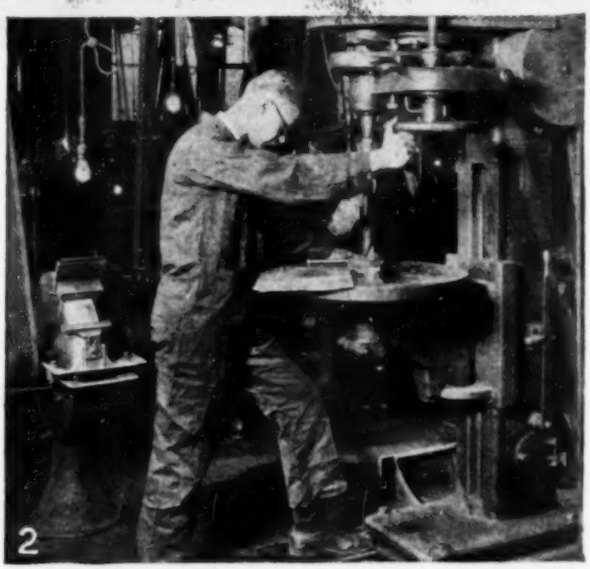
The myth of abnormal steel no longer enters into the calculation of results and satisfactory carburizing depends entirely upon proper temperature and time, arrangement of parts within container, and kind of carburizer.

Body Nomenclature Survey

To determine the extent to which the industry has adopted the S.A.E. Standard Nomenclature for various types of open and closed bodies, the manufacturers of passenger-cars have been asked to inform the society what names they use for the various types. It is expected that this survey will reopen the question as to the proper name for the five-passenger two-door type of body, generally called by car manufacturers "coach" or "brougham." The passenger-car body division has never specified a standard name for this type of body, on the basis that the standard nomenclature is intended to apply to the basic types of body and that variations of such basic types should include the basic name properly qualified.

The results of the general survey will enable the passenger-car body division to make a further study of the standard nomenclature and to decide what changes, if any, are desirable.





Where Boys Learn Practical Shop Work

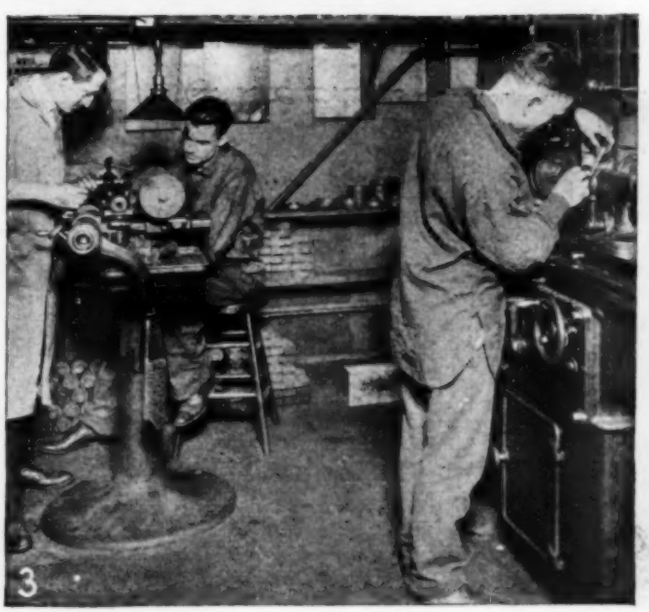
1—General view of machine shop

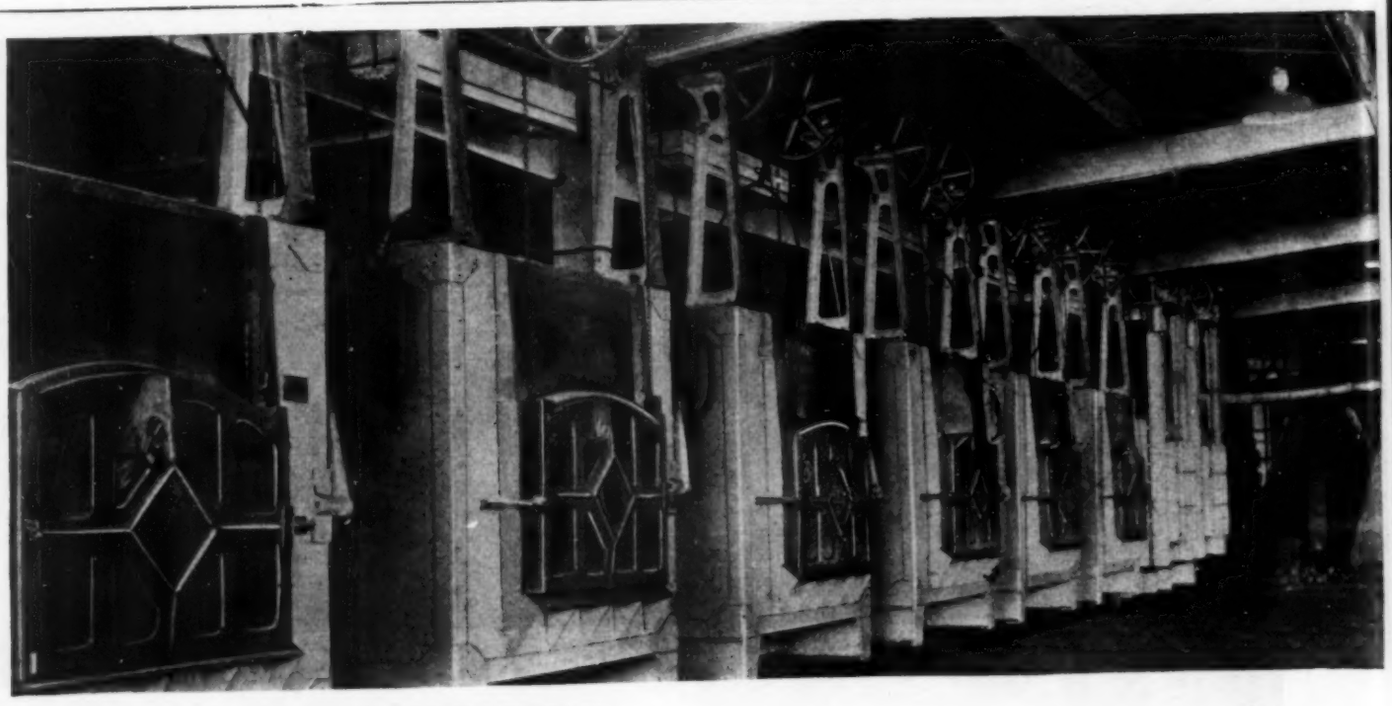
2—Using a heavy vertical drill

3—In the grinding department

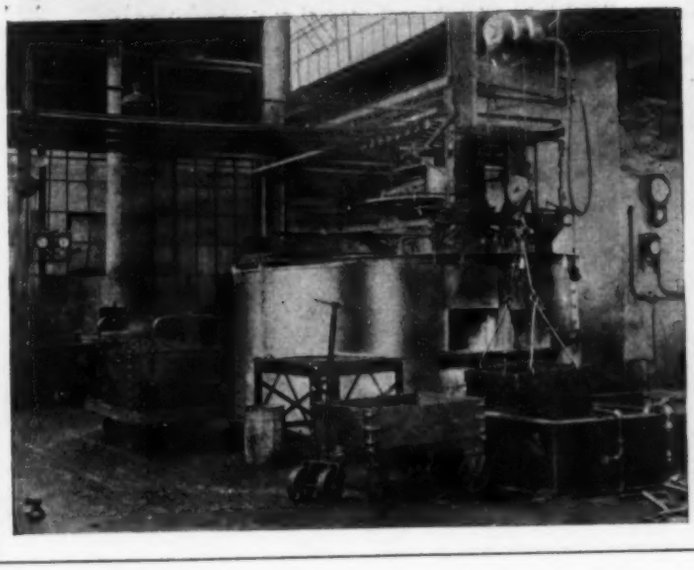
4—Engine- and turret-lathe work

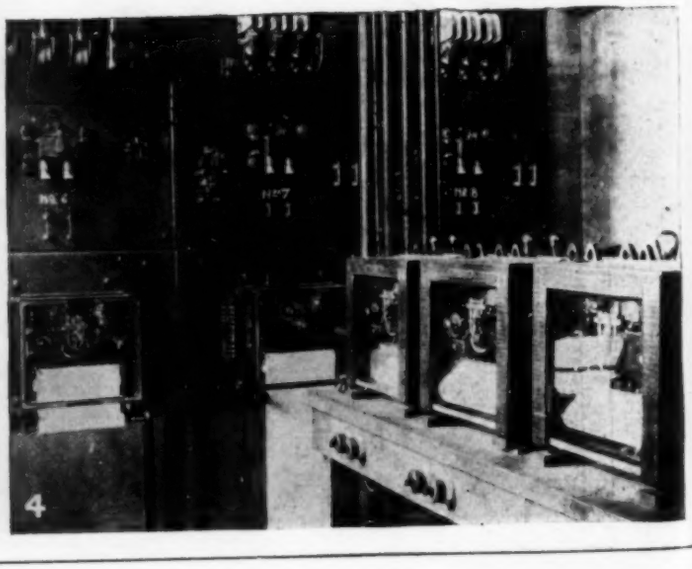
Photographs by courtesy of the Drexel Institute, Philadelphia





Where the Nash Parts are Heat-Treated





1—A battery of electrically-operated heat-treating furnaces.

2—Method used for loading furnaces. The tubes shown on the truck each contain nine camshafts about to be carbonized.

3—Rotary-type electric furnace used for a variety of parts showing the air hoist and quenching tanks.

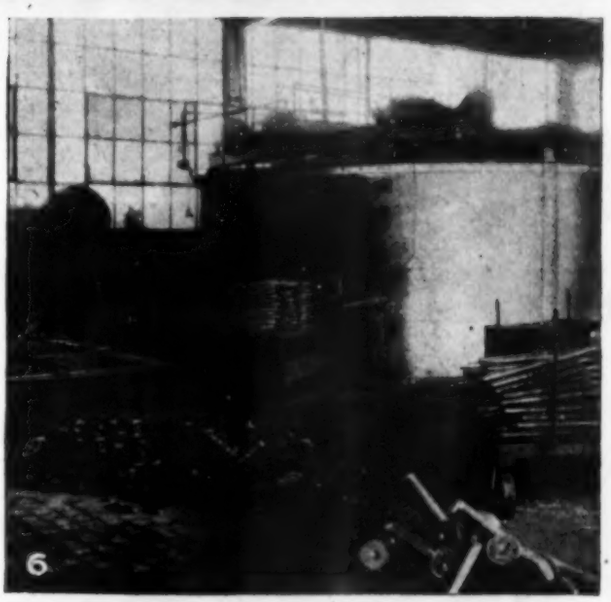
4—Recording devices used for checking the temperatures of the furnaces.

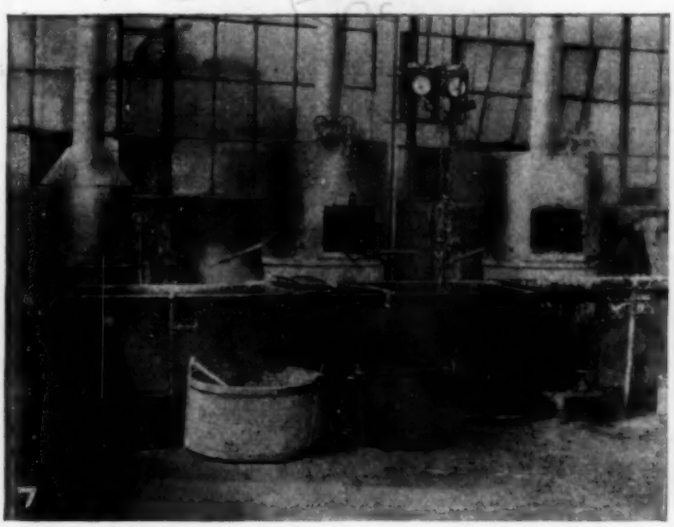
5—General view of the heat-treating department.

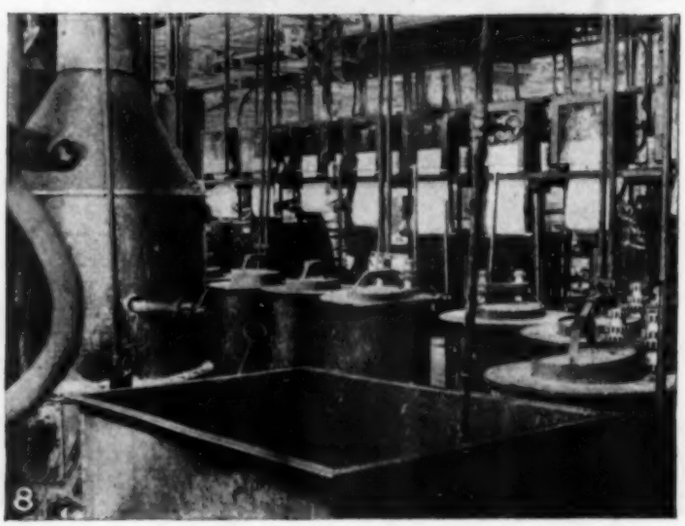
6—One of the larger sized rotary furnaces. The work makes one complete turn inside the furnace, the speed of which may be regulated according to its size.

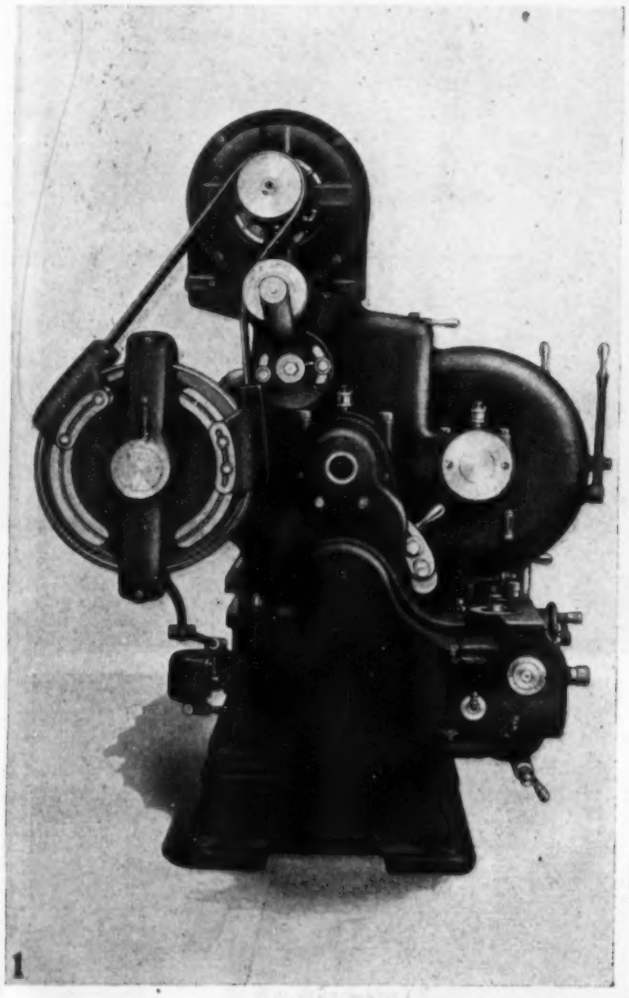
7—Cyanide furnaces used for hardening brake levers, valve push-rods, starting-crank clutch and other units.

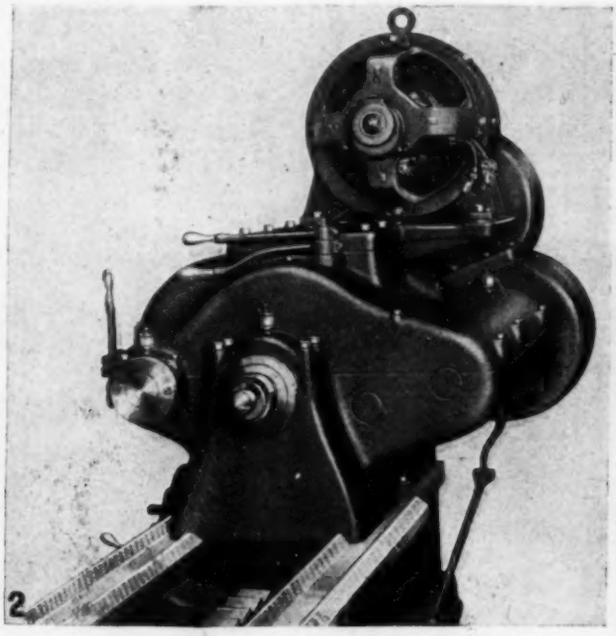
8—Furnaces used for hardening transmission gears. The heat of each furnace is recorded by an individual instrument shown behind the furnaces.











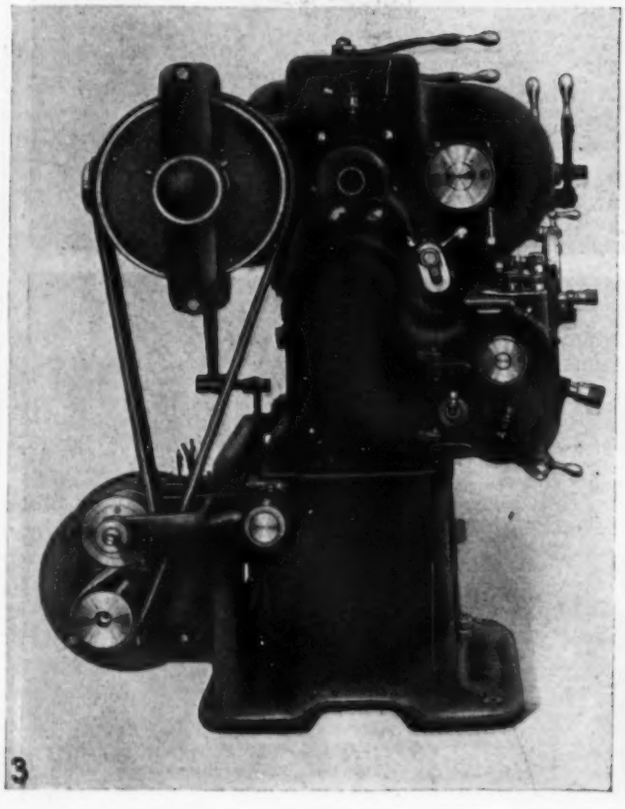
Modern Methods of Mounting Motors

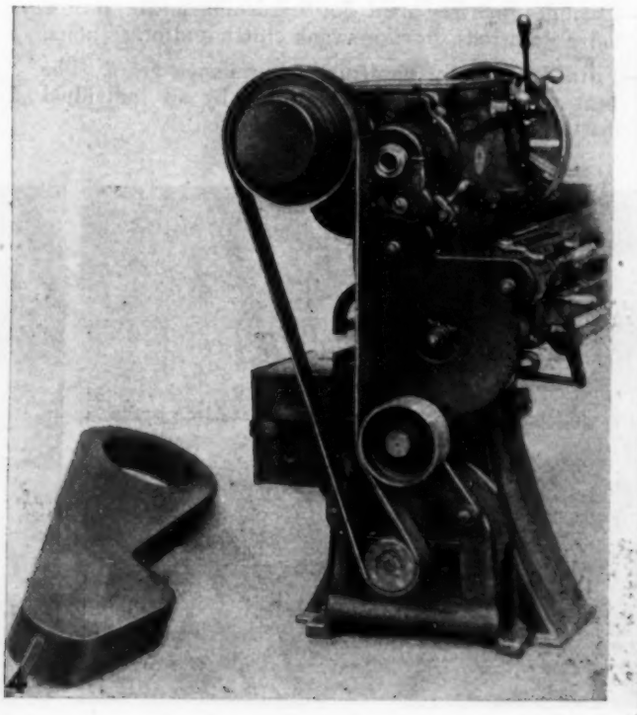
1—Boye & Emmes motor-belt drive

2—Boye & Emmes motor-gear drive

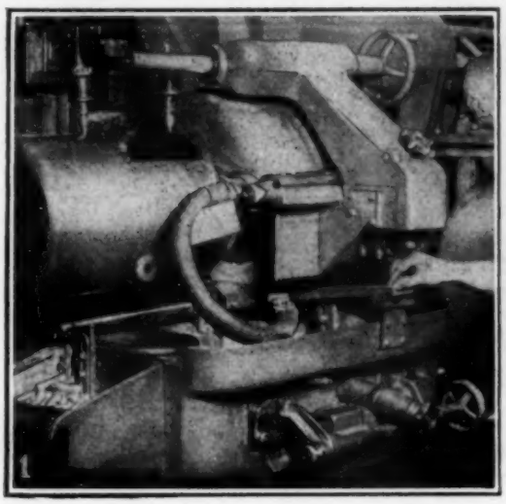
3—Another Boye & Emmes motor-belt drive

4—R. K. LeBlond motor-in-base drive





Automotive Production



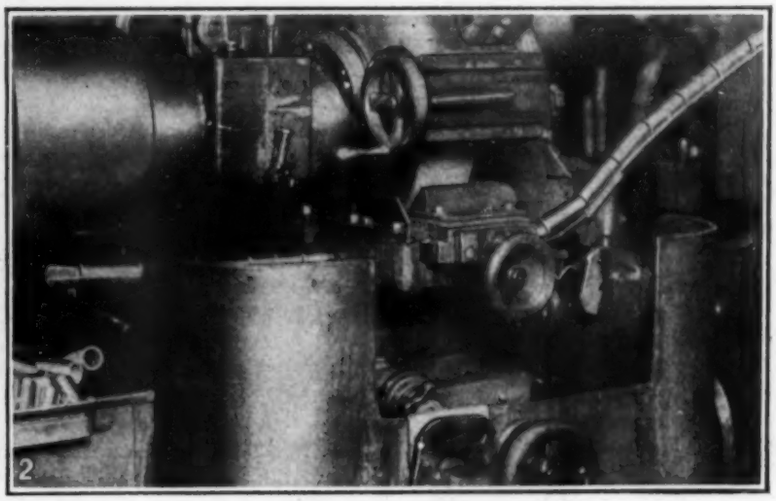


Fig. 1—Arrangement of grinding and regulating wheels in horizontal machine
Fig. 2—How the work is supported

Getting Better Results With Centerless Grinders

By W. W. Seabury
Ford Motor Company

Range of work wider than generally supposed—Gravity magazine renders the centerless grinder automatic—Fast and accurate work in grinding pistons and piston pins

IN THE production of cylindrical parts, the centerless grinder represents a radical departure from the method of holding the work between centers during the machining operation. It fulfills the demand for giving a precision finish to cylindrical parts at a minimum of cost and at an increased production rate. This is due to the process being continuous.

The general opinion among many engineers and production men, is that the scope of the centerless grinder is limited to small cylindrical parts, ranging from ⅛ in. to 3 in. in diameter; that it is primarily efficient as a finishing machine, and not as fast in machining cast-iron and steel parts as accurately as the various special turning machines on the market. Our experience has proved, however, that the range of work is very wide.

The machine has two wheels, a high-speed grinding wheel and an opposed regulating wheel, the latter revolving slowly, opposite the high-speed wheel and forming a grinding throat as shown in Fig. 1. The part to be finished is fed into the throat of the wheels by gravity and is supported by a work rest. The grinding wheel serves entirely for grinding purposes. The regulating wheel has two functions, first, to control the speed of rotation of the work and second, to regulate the feeding movement. With a hopper feed which brings the work to the rest, and with the regulating wheel feeding it through the machine, the operation of the centerless grinder becomes automatic.

The capacity of the machine depends upon several factors: 1—The angular adjustment of the regulating wheel; that is the angle of its axis to that of the grinding wheel. 2—The abrasive capacity and speed of the grinding wheel. 3—The amount of stock to be removed. 4—The finish required. 5—The type of work

Abstract of a paper presented at the New Haven Meeting of the A. S. M. E., September 8-11, 1925.

AUTOMOTIVE PRODUCTION

to be ground, whether solid or hollow with thin walls.

There are two primary methods of grinding the work with the centerless grinder, each of which has its advantages and is adaptable to a certain form of work. Some of the best examples of the "through-feed" method in our production, are the Model-T and Tractor pistons, piston pins and brake shoes. An example of the "infeed" method, is the push rod.

Before the introduction of the centerless grinder, it required 43 machines and approximately 130 men to produce 50,000 Model T piston pins per 24-hr. day, or 384 finished pins per man per day. With the centerless grinder, the production jumped to 66,000 pins with 157 men operating 26 machines, or a production increase of 36 pins per man. There was also a 10 per cent reduction in cost, plus a further reduced cost resulting from the decrease in maintenance per machine and the fewer machines required, also the minimizing of investment in machinery and floor space required. Another pertinent factor in cutting the total cost 60 per cent, was the reduction in scrap of over 30 per cent, and the greater accuracy obtained. Limits were reduced to 0.0004 in. for roundness and taper.

The grinding of the tractor-piston pin is another part where greater accuracy, increased production and reduced cost were obtained with the "through feed," centerless grinder. The grinding operation of the centerless machine being done on the three-point contact method, as distinguished from the one-point contact with the center-type grinder, accounts for the fast cutting action of the machine and accuracy of the work. In the centerless machine, the work is supported directly opposite the grinding wheel by the regulating wheel, and also at another point opposite by the rest, as may be seen in Figs. 2 and 5. Some idea of the accuracy obtained may be had by the fact that a pin does not pass inspection if the error exceeds 0.0002 in. in roundness or taper. On this pin 1⅜ in. in diameter, from 0.018 in. to 0.020 in. is removed from the diameter in three passes in the roughing. About 0.0035 in. is removed in five finishing operations as follows:

1st pass—0.0012 in.	4th pass—0.0005 in.
2nd pass—0.0008 in.	5th pass—0.0003 in.
3rd pass—0.0007 in.	Total—0.0035 in.

In order to detect any inaccuracy in the piston pins at inspection, the gaging method, similar to the three point principle employed in the centerless grinder, is used. Experience determines the best angle of the driving wheel axis with that of the grinding wheel axis. It depends upon the type of work, kind of finish required and the amount of stock to be removed. In the case of the tractor-piston pin just described, the angle of 3 deg. was found to be the best.

Eleven center-type grinders have been replaced by three centerless machines, producing the same number of pins and eliminating eight men. The production of pins per man was increased 159 per eight hours. It might be mentioned that with centerless grinding on this type of work, where precision is paramount, an absolutely dead round diameter may be ground without any trace of chatter marks whatever. After the final operation on the grinder, the piston pin had apparently a perfect finish, but when the lapping machine was installed it showed up the imperfections of grinding by giving a mirror like finish to the pin. The lapping machine is not to rectify any inaccuracies in parallelism or roundness, but merely to obtain an absolutely mirror-finished surface. The production from one lapping machine is from 6 to 8 pins per minute.

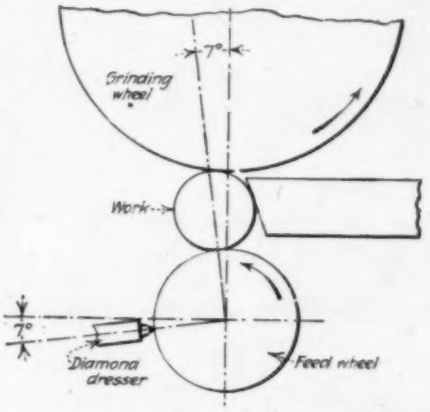
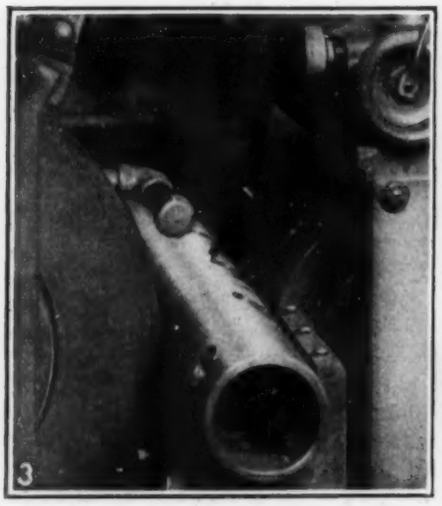


Fig. 5—Relation of workrest and work to the wheels

The centerless grinder has made it possible to machine lighter pistons with the greatest accuracy, without the distortion due to chucking, which is unavoidable in a turning machine, and also without the distorting effect of a cutting tool. We will consider the



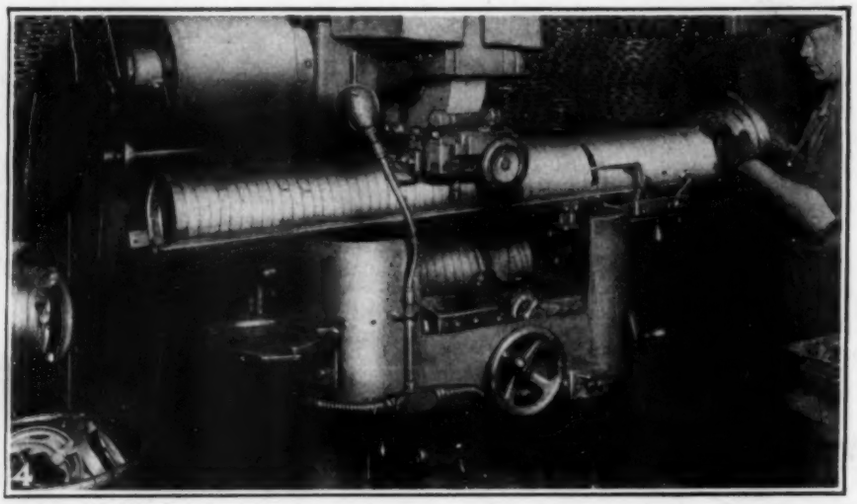


Fig. 3—Grinding pistons. Fig. 4—Vertical-type centerless grinder

AUTOMOTIVE PRODUCTION

light, close-grained gray-iron piston and the very much lighter steel piston used by our company.

Because of their lightness, the walls are of thin section. Therefore the satisfactory chucking and machining on a lathe, becomes more of a problem as the demand for lighter pistons increases.

It has been our experience in the turning of pistons, that the intermittent striking and receding action of the tool in going over the piston-pin hole, made it almost impossible to produce a round piston, regardless of taking lighter cuts and relieving a section around the hole. It was not unusual to find pistons having a wavy appearance after the finish operation, regardless of the heat-treatment or seasoning of the metal. The cause is attributed to the variation in the texture of the metal, and the consequent springing action of the tool, due to the variation in hardness, commonly called hard spots at various points on the piston surface.

Accurate and Simple Operation

Centerless grinding greatly simplifies the problem of finishing pistons accurately. In the case of the cast-iron piston, the finishing operation is done by the centerless grinder as shown in Fig. 3. The amount of stock removed is 0.003 in. in the first operation through the centerless machine, and 0.001 in. on the finishing operation. Although the production runs about 50,000 pistons per day, the accuracy has been increased with the centerless machine, so that the tolerance is now plus or minus 0.0005 in., as compared with plus or minus 0.002 in. when the finish operation was a turning operation. The life of a grinding wheel on this job is about 50 days. The size of wheel is 20x4x9 in. and it is dressed about four times in 24 hours.

With the "through-feed" method of centerless grinding, we have discussed work that has been done on the centerless grinder of the type having the grinding and regulating wheels mounted with their axes in a horizontal plane and opposite each other. The other is the vertical opposed type, Fig. 4, and has the grinding wheel mounted directly above the regulating wheel. The latter type has the advantage in grinding narrow work of large diameter, such as the Ford brake shoe, a casting about 1 in. wide and 8 in. in diameter. The casting is held to within ½-in. limits in the foundry.

The 0.032 in. of stock to be removed is ground off in the vertical-type, centerless grinder in two passes, and the limits maintained are 0.002 in. for roundness. The cutting capacity is about 5 cu.in. per min. It might be well to mention that at the start of the use of the centerless grinder, 1,500 shoes were ground per wheel, but after considerable effort on the part of wheel manufacturers, the average shoes per wheel now run from 15,000 to 20,000, dressing the wheel only once at the start. The wheel is now used to within ¾ in. of the hole.

Formerly, twelve center-type machines with special heads and tailstocks were used for grinding 1,000 pins per machine in three shifts. Now the same production is maintained with four centerless grinders, running two shifts, eliminating 27 men. With the center-type machine, the closest limit to which it was possible to hold the brake shoes was 0.010 in. in roundness, the present limit is 0.002 in. The breakage has been cut from 600 to less than 100 per day. The speed of the grinding wheel on the first-operation machines is 1,000 r.p.m. and on the second-operation machine it is 1,280 r.p.m. The size of grinding wheel used is 18x4x7½ in. The vulcanite regulating wheel is 9½ in. O.D. and 8 in. wide.

The relation of the work rest and the work to the grinding and feed wheels is very important. For example, on the vertical type of machine, the diamond is set at an angle of 7 deg. with the horizontal line going through the feed wheel, and at 90 deg. with a line going through the center of the work. This line makes an angle of seven degrees with the vertical axis passing through the centers of the grinding and feed wheels.

It is very important to keep the grinding wheel sharp and free from gumming, by using plenty of clean water with just enough soda and oil to keep the machine from rusting. The compound recommended is 92 per cent water, 5 per cent plain soda and 3 per cent machine oil. The actual decrease in cost of producing the brake shoe, was over 70 per cent with the centerless grinder.

For finish grinding, the vertical type of machine seems to have a slight advantage over the horizontal type. The regulating wheel should overlap the grinding wheel 2 in. on each side, causing the work to spin before and after reaching the grinding wheel, thereby preventing any nicking or flat spots on the finished surface. This applies to straight grinding or the "through feed" method only.

Shoulder grinding is done by having the grinding wheel oscillate. The regulating wheel for this class of work is of the same width as the grinding wheel. For automatic feed, the vertical-type machine gives better results, both as regard to production and accuracy.

British Devise Test for Strength of Materials

An ingenious test for materials for aircraft has been devised by English engineers. It is based on the "crippling load" and takes the place of the "proof" test which has been in use heretofore for the acceptance of structural steel strip. The proof test specifies a certain minimum deformation resulting from the application of a proof tensile stress, but the validity of the criterion has been questioned.

In the new test the strip is partly subdivided into three strips by rows of perforating holes; the strip is then placed in a machine which pulls the two outer portions in one direction and the inner strip in the opposite direction. Buckling is then produced in the intermediary sections, and this buckling is said to correspond to the stress condition to which the strip would be exposed when used in aircraft.

This test is just another that has been devised in the desire to parallel actual conditions which must be met in the air, conditions that are not covered by methods previous to the coming of the airplane.

Ideas from Practical Men

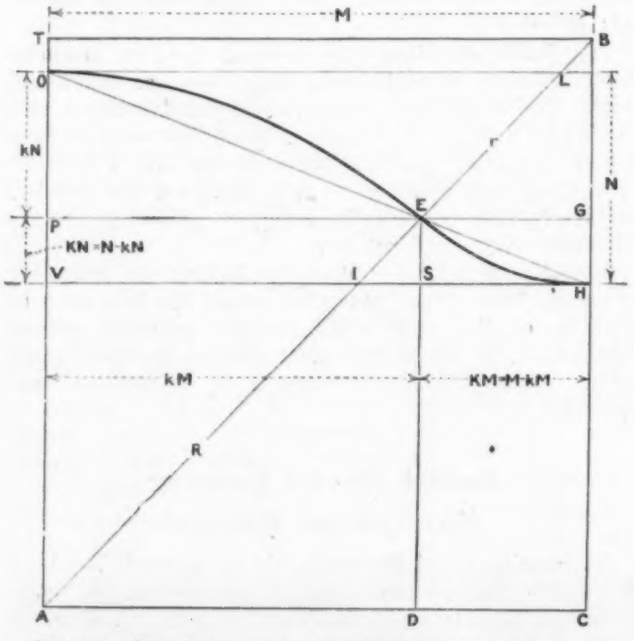
The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from five dollars upward, according to their merit

A Reverse Curve Formula—Discussion

By W. Roland Needham
Essex, England

The article by Hubert G. Smith, under the title given above, and published on page 570, Vol. 62, of the *American Machinist*, dealt with equal reverse curves alone.

The formula given below may be used to determine the proper radii for unequal reverse curves. The accompanying illustration shows the problem involved.



Layout of reverse curves and construction to show relation of the diameters

Wanted: Reverse curves with two radii R and r, or AE and BE

AE and BE are divided into parts the ratio of which is that of AD and DC in the similar triangles ADE and ACB.

$$\text{Let } k = \text{the ratio of } \frac{AE}{AB} \text{ and } K = \frac{EB}{AB}$$

$$\frac{AE}{AB} + \frac{BE}{AB} = \frac{AB}{AB}$$

$$\frac{BE}{AB} = 1 - \frac{AE}{AB}, \text{ or } K = 1 - R$$

Given M and N, to determine $AE + BE$. Having chosen and found either one, the other will follow.

$$\frac{AD}{AC} = \frac{AE}{AB} \text{ (similar triangles)}$$

$$AD = \frac{AE}{AB} \times AC$$

$$\therefore AD = kM$$

$$DC = M - RM = M(1-k) = KM$$

$$VH = AC \text{ (sides of rectangle)}$$

$$\frac{AE}{AB} = \frac{AD}{AC} = \frac{VS}{VH}$$

$$\text{Since } \frac{OE}{OH} = \frac{VS}{VH}$$

$$k = \frac{OE}{OH}$$

$$\frac{OP}{OV} = \frac{OE}{OH}$$

$$OP = \frac{OE}{OH} \times OV$$

$$\therefore OP = kN$$

$$PV = N - kN = N(1-k) = KN$$

$$R^2 = AD^2 + DE^2$$

$$DE = AP = AO - PO$$

$$R = AO$$

$$\therefore DE = R - kN$$

$$\therefore R^2 = (kM)^2 + (R - kN)^2$$

$$R^2 = (kM)^2 + R^2 - 2R(kN) + (kN)^2$$

$$R^2 - R^2 + 2R(kN) = k^2M^2 + k^2N^2$$

$$R = \frac{k(M^2 + N^2)}{2N} = \frac{k}{2}\left(\frac{M^2}{N} + N\right) \quad (1)$$

Similarly:

$$r^2 = (KM)^2 + (r - KN)$$

$$= (KM)^2 + r^2 - 2r(KN) + (KN)^2$$

$$\therefore r = \frac{K}{2}\left(\frac{M^2}{N} + N\right) \text{ or } \frac{1-k}{2}\left(\frac{M^2}{N} + N\right) \quad (2)$$

$$\text{Then } R + r = (1) + (2) = \frac{1}{2}\left(\frac{M^2}{N} + N\right) \quad (3)$$

$$\text{Consequently } R = \frac{1}{2}\left(\frac{M^2}{N} + N\right) - r \quad (4)$$

$$\text{and } r = \frac{1}{2}\left(\frac{M^2}{N} + N\right) - R$$

The reader will find that for any given values M and N, and varying values k, he will obtain a series of parallel diagonals, $R + r$, of the same length.

In the example of equal radii given by Hubert G. Smith,

$$R = \frac{1}{2}(R + r),$$

whence in equation (3) $R = \frac{1}{4}\left(\frac{M^2}{N} + N\right)$.

This agrees with his result.

This is the same discussion on this subject that was printed on page 442 of the Sept. 10 issue. The illustration of the problem was omitted then, and therefore the whole article is reprinted here in full.

IDEAS FROM PRACTICAL MEN

Holding and Machining Driving Boxes

By Herbert F. Crawford

Driving-box work is one of the steady jobs in all locomotive repair shops, and there are about as many ways of doing the work as there are kinds of driving boxes. A few of the operations are shown herewith, the illustrations being from different roads.

In Figs. 1 and 2 are two methods of holding driving boxes while being planed for the shoe and wedge fits. In Fig. 1, the central or supporting wall of the fixture is of box section, while in Fig. 2, there are two ribbed angle plates held to the table by straps and bolts. The driving boxes are bolted in place by similar means in both cases.

Another method of machining the boxes for the shoes and wedges is shown in Fig. 3 where the box is mounted on a draw-cut shaper, using a parallel block as a support, an angle plate being used to square the box. This view shows the crown brass in place and the cone-headed studs screwed into the box to hold the wear plate, when it is cast in place.

A method of finishing the seat for the crown brass is shown in Fig. 4. Here the slotter is utilized and the tool bar is piloted in the table, so as to insure accuracy by avoiding spring as the tool travels down through the box. As can be seen, the tool is fitted in a clapper box to relieve it on the up stroke.

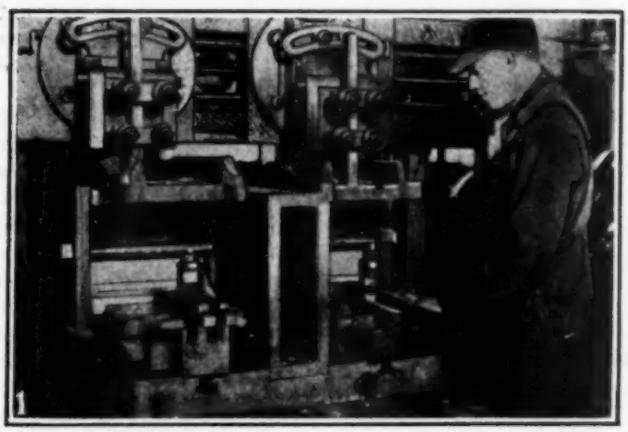


Fig. 1—Fixtures for holding driving boxes in pairs

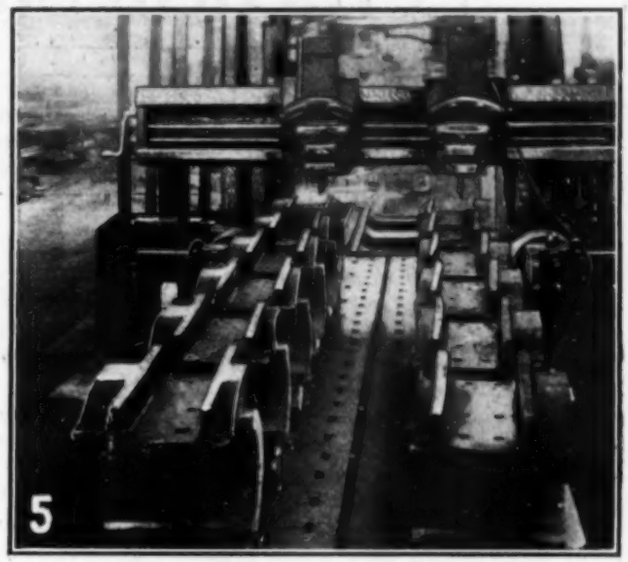
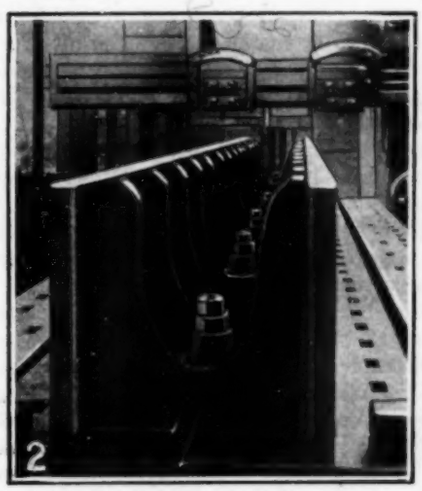
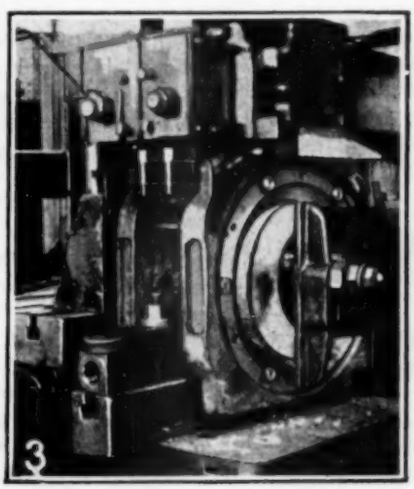


Fig. 5—Planing rocking driving boxes

On some roads the shoe and wedge fits of the driving boxes are planed to a double taper on the sides, so as to allow the boxes to shift when the wheels on one side are higher than on the other. This planing is done by offsetting the boxes as shown in Fig. 5, where six boxes are lined up in each string. In this position the upper end of one side and the lower end of the opposite side of each box are planed at the same setting—shifting the boxes to the reverse position, allows the remaining angular surfaces to be planed. The short, straight, central portions are planed with the boxes set parallel.

This method requires three separate settings but since no great degree of accuracy is required the time thus spent is comparatively short.





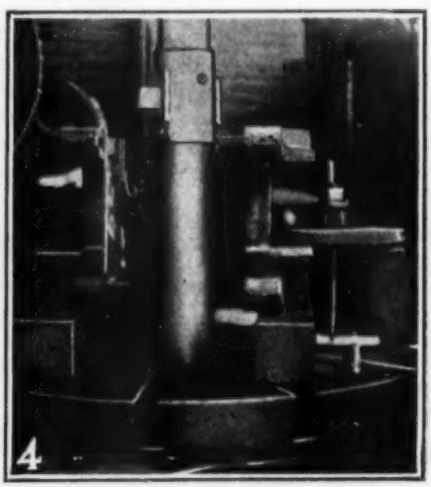


Fig. 2—Angle plates for holding driving boxes in strings. Fig. 3—Planning a driving box on a Morton draw-cut shaper. Fig. 4—Machining the crown-brass seat on a slotter

Practical Shop Problems

Questions of a Practical Nature will be answered in these columns

Measuring Liquid in Horizontal Cylindrical Tanks

Q. We desire to know a means of telling the approximate amount of liquid in each of a number of horizontal cylindrical tanks by measuring the depth of the liquid. It would be sufficiently accurate if we had a measuring stick graduated every few inches.

A. Since you have not given us the tank sizes we are unable to give you actual volume figures but we know of a table published in Marks' Mechanical Engineering Handbook that has worked your problem out nicely in terms of per cent. With this table you can apply your known values and graduate a measuring stick. The table follows:

Ratio of heights of liquid to diameter of tank	Ratio of area of liquid segment to area of end
0.0	0.0000
0.05	0.0187
0.10	0.0520
0.15	0.0941
0.20	0.1424
0.25	0.1955
0.30	0.2523
0.35	0.3119
0.40	0.3735
0.45	0.4364
0.50	0.5000

The volume of one-half of a tank in gallons is

$$\frac{\pi R^2 L}{231 \times 2}$$

where R is the radius in inches, and L is the length in inches and 231 is the number of cubic inches per gallon.

Applying the given set of tank dimensions to this formula, and multiplying it by the value in the right-hand column of the table corresponding to a measured per cent of liquid depth, which is shown in the left-hand column will give the volume for that given depth. For depths of more than half the tank diameter, figure the per cent that is not filled and subtract the corresponding volume fom the total capacity of the tank.

Grain, Grade and Grinding-Wheel Abrasive

Q. What is the difference between grain and grade in speaking of grinding wheels?

A. The term grain designates the abrasive particles in the wheel as to their size. Grade refers to the degree of hardness of the wheel and is a measure of the strength of the bond and its ability to retain hold of the abrasive as the wheel is put to work.

Grade should not be used with reference to the hardness of the abrasive, for depending on the bond, no matter how hard the abrasive is, the wheel may be very soft.

Grade, further, should not be taken as an exact measure since any given grade is meant to represent a range of wheel hardness between an upper and a lower limit.

Therefore, to designate a certain wheel there are three variables. Abrasive, signifying the nature of the grinding medium, grain, having to do with the size of the grinding medium, and grade, applying to the hardness of the bond.

Step-Bearing Design

Q. We have a step-bearing problem in our plant in connection with a 12-in. vertical shaft carrying a 75-ton rotating load. We desire to know something of the various designs of step bearings and the allowable unit bearing pressures.

A. In general, there are four types of step bearing for use in connection with vertical shafts, a multiple-disk bearing, an oil-pressure bearing, a ball-thrust bearing and one using rollers. Any of these types may or may not have a self-aligning conical seat, but those that do are greatly to be preferred.

Again in general, the unit oil pressures for the multiple-disk bearing, which employs a number of carefully machined plates of alternating materials below the shaft should not exceed 500 lb. per square inch. The unit is flood-lubricated up through a hole in the center and out through oil grooves cut in the disks. A design which among others can exceed this unit pressure is known as the Kingsbury, which when flooded can be operated in excess of 1,000 lb. per square inch. Care must be exercised with this bearing in starting and stopping.

With the oil-pressure bearing, the shaft is provided with a step on the bottom which is cupped out in the center. This step rides on a flat plate, through the center of which oil is pumped until the pressure is sufficient to raise the step from the plate. The oil then flows between the two and back to the pumping system. Obviously, the pump must have sufficient volume as well as pressure capacity to maintain the flow.

Using a good grade of turbine oil, a unit pressure of 1,000 lb. can be maintained. The wisdom of exceeding this figure, however, is doubtful. It is necessary in this type of bearing to have an oil-filtering system and a provision for adequate cooling, making the installation comparatively costly and complicated.

The ball or roller bearing, while it has limitations of its own such as the tendency of the roller type to groove, does not depend directly on the oil to function. There is no film to maintain, the pressure depending directly on the area of contact and the materials used.

We suggest that you investigate all of these designs, sending inquiries to the makers of the various types for recommendations and quotations. We warn against your attempting yourself to handle the problem on account of the weights with which you are dealing.

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Cutting Speed Conversion Table

Surface Feet to R.P.M.

Diam. in Inches	FEET PER MINUTE														
	90	95	100	110	120	125	130	140	150	160	170	175	180	190	200
	REVOLUTIONS PER MINUTE														
1/16	5502	5808	6114	6725	7337	7643	7948	8560	9171	9782					
1/8	2750	2903	3056	3362	3667	3820	3973	4278	4584	4890	5195	5348	5501	5806	6112
3/16	1834	1936	2038	2242	2446	2548	2649	2853	2157	3261	3465	5367	3668	3872	4076
1/4	1376	1453	1528	1681	1734	1910	1986	2139	2292	2445	2598	2674	2750	2903	3056
5/16	1100	1161	1222	1344	1466	1527	1589	1711	1833	1955	2077	2139	2200	2322	2444
3/8	916	967	1018	1121	1222	1273	1323	1425	1527	1629	1731	1782	1832	1934	2036
7/16	786	830	874	961	1049	1093	1136	1224	1311	1398	1486	1530	1573	1661	1748
1/2	688	726	764	840	917	955	993	1070	1146	1222	1299	1337	1375	1452	1528
9/16	611	645	679	747	813	869	883	951	1019	1086	1154	1188	1222	1290	1358
5/8	552	581	612	673	736	765	796	857	918	979	1040	1071	1102	1163	1224
11/16	500	527	555	611	666	692	722	770	833	888	944	971	999	1054	1110
3/4	458	483	508	559	610	635	661	711	762	813	864	889	914	965	1016
13/16	427	450	474	521	569	593	616	664	711	758	806	830	853	901	948
7/8	392	416	438	482	526	548	569	613	657	701	745	767	788	832	876
15/16	366	387	407	448	488	509	529	570	611	651	692	712	733	773	814
1	344	363	382	420	458	478	497	535	573	611	649	669	688	726	764
1 1/16	323	341	359	395	431	449	467	503	539	579	610	628	646	682	718
1 1/8	306	324	340	374	408	425	442	476	510	544	578	595	612	646	680
1 3/16	290	306	322	354	386	403	419	451	483	515	547	564	580	612	644
1 1/4	274	291	306	337	367	383	398	428	459	490	520	536	551	581	612
1 5/16	262	276	291	320	349	351	378	407	437	466	495	509	524	553	582
1 3/8	250	264	278	306	334	348	361	389	417	445	472	487	500	528	556
1 7/16	239	251	265	292	318	331	345	371	398	424	451	464	477	504	530
1 1/2	230	241	254	279	305	318	330	356	381	406	432	445	457	483	508
1 9/16	220	232	244	268	293	305	317	342	366	390	415	427	439	464	488
1 5/8	212	222	234	257	281	293	304	328	351	374	398	410	421	445	468
1 11/16	203	215	226	249	271	283	294	316	339	362	384	396	407	429	452
1 3/4	196	207	218	240	262	273	283	305	327	349	371	382	392	414	436
1 13/16	190	200	211	232	253	264	274	295	317	338	359	369	380	401	422
1 7/8	184	194	204	224	244	255	265	286	306	326	347	357	367	388	408
1 15/16	177	187	197	217	236	246	256	276	296	315	335	345	355	374	394
2	172	181	191	210	229	239	248	267	287	306	325	334	344	363	382
2 1/8	162	171	180	198	216	225	234	252	270	288	306	315	324	342	360
2 1/4	153	162	170	187	204	213	221	238	255	272	289	298	306	313	340
2 3/8	145	153	161	177	193	201	209	225	242	258	274	282	290	306	322
2 1/2	138	145	153	168	184	191	199	213	230	245	260	268	275	291	306
2 5/8	131	138	145	160	174	181	189	203	218	232	247	254	261	276	290
2 3/4	125	132	139	153	167	174	181	195	209	222	236	242	250	264	278
2 7/8	119	125	132	145	158	165	172	185	198	211	224	231	238	251	264
3	114	121	127	140	152	159	165	178	191	203	216	222	228	241	254
3 1/8	110	116	122	134	146	153	159	171	183	195	207	214	219	232	244
3 1/4	105	111	117	129	140	146	152	164	176	188	199	205	211	222	234
3 3/8	102	108	113	124	136	141	147	158	170	181	192	198	203	215	226
3 1/2	98.1	104	109	120	131	136	142	153	164	174	186	191	196	207	218
3 5/8	94.5	99.8	105	116	126	131	137	147	158	168	179	184	189	200	210
3 3/4	91.8	96.9	102	112	122	128	133	143	154	163	175	179	184	194	205
3 7/8	88.6	93.6	98.5	108	118	123	128	138	148	158	167	172	177	186	197
4	86.0	90.8	95.6	105	115	120	124	134	143	153	163	167	172	182	191
4 1/4	80.8	85.3	89.8	98.8	108	112	117	126	135	144	153	157	162	171	180
4 1/2	76.3	80.6	84.8	93.3	102	106	110	119	127	136	144	148	153	161	170
4 3/4	72.4	76.4	80.4	88.4	96.9	101	105	113	121	129	137	141	145	153	161
5	68.8	72.6	76.4	84.0	91.7	95.5	99.3	107	115	122	130	134	138	145	153
5 1/4	65.4	69.1	72.7	80.0	87.2	90.9	94.5	102	109	116	124	127	131	138	145
5 1/2	62.5	65.9	69.4	76.3	83.3	86.8	90.2	97.2	104	111	118	121	125	132	139
5 3/4	59.8	63.1	66.4	73.0	80.0	83.0	86.3	93.0	99.6	106	113	116	120	126	133
6	57.2	60.5	63.6	70.0	76.3	79.5	82.7	89.0	95.4	102	108	111	114	121	127
6 1/4	55.0	58.0	61.1	67.2	73.3	76.4	79.4	85.5	91.7	97.7	104	107	110	116	122
6 1/2	52.8	55.8	58.7	64.6	70.4	73.4	76.3	82.2	88.1	93.9	100	103	106	112	117
6 3/4	50.9	53.8	56.6	62.3	67.9	70.8	73.6	79.2	84.9	90.6	96.2	99.0	102	108	113
7	49.1	51.9	54.6	60.1	65.5	68.3	71.0	76.4	81.9	87.4	92.8	95.6	98.3	104	109
7 1/4	47.4	50.1	52.7	58.0	63.2	65.9	68.5	73.8	79.1	84.3	89.6	92.2	94.9	100	105
7 1/2	45.8	48.4	50.9	56.0	61.1	63.6	66.2	71.0	76.4	81.4	86.5	89.1	91.6	96.7	102
7 3/4	44.3	46.7	49.2	54.1	59.0	61.5	64.0	68.9	73.8	78.7	83.6	86.1	88.6	93.5	98.4
8	43.0	45.4	47.8	52.6	57.4	59.8	62.1	66.9	71.7	76.5	81.3	83.7	86.0	90.8	95.6

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Trim Line

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Technical Abstracts

Ball Bearing Quality

H. G. Freeland of the Hoover Steel Ball Co. describes some of the more important fundamentals governing the design, manufacture, application and care of bearings. The manufacturer of ball races must, first of all, buy the right type of steel and the best possible grade. The best practice at the present time is to use a steel having a carbon content of 1 per cent and of chromium between 1.25 and 1.50 per cent. This should be an electric-furnace or crucible product. The inspection is of great importance—the raw steel should be examined particularly for seams, pipes and decarburization. Inspection should be made after etching the coils or bars to remove the scale and surface metal. As it is usually impossible to inspect coils perfectly, it is best to take a liberal sample and reject all coils manifesting a seam defect. The smaller sizes of balls are formed from wire that is received in coils. This wire is cold pressed in a machine that shears off a slug of correct length and automatically carries it betweeen dies which compress it into the form of a ball blank. The larger sizes are made from hot-rolled bar stock, the slugs being sheared hot and the ball blanks formed under a drop hammer. The blanks of various sizes are then dry-ground to remove the major portion of excess stock, leaving enough stock on the ball to take care of any scale which may be formed during subsequent heat-treating operations. The balls go from the dry-grinding department to the heat-treatment department where they receive the necessary heat-treatment and are finally oil tempered. Scale is removed from the balls by tumbling barrels with abrasive for a short period of time. Hoffman machines reduce the balls to within a few ten thousandths of their finished required diameter. They are then carefully cleaned and polished in leather to remove any moisture from the surfaces and are delivered to the inspection department for examination. The surfaces of the finished balls are sensitive to oxidation and operators use gloves to prevent the balls becoming attacked by the moisture and acid that are ever present on the hands.—*Transactions of the American Society for Steel Treating*, Sept. 1925, p. 309.

Making Castings From Iron Borings

The handling of iron borings in an ordinary cupola is an unpleasant job; however, by using an electric furnace much better and more economical results can be obtained. Recently a manufacturer of railroad and locomotive equipment in the Central South installed a 1½-ton acid electric furnace in which the iron borings of the machine shops amounting to 140 tons per month are melted. The molten metal was poured directly into castings and it was after considerable experiment they decided to use the metal for making locomotive piston rings. To 3,000 lb. of iron borings, 20 lb. of extremely fine coke was added and well mixed and then charged in a furnace, power turned on and when the iron was melted tests were taken to give an estimated idea of the silicon content.

The cost of the cupola iron was $34.50 and the cost of this electric furnace iron $20.66 per ton, showing a decided saving. Figuring this on a scrap boring production of 140 tons a month, it realizes a saving of over $23,000 per year and at the same time gives a product superior in quality and strength with a smaller casting loss due to rejections. —*Iron Trade Review*, Sept. 10, p. 626.

Light Control

It can be shown that a very small portion of a beam of light striking a piece of glossy paper or porcelain enamel is reflected in a manner similar to that of a plane mirror. In other words, 5 to 10 per cent of the light striking such a surface will be reflected by direct reflection, the remainder of the light is reflected at various angles and the major portion of this remainder travels in a direction perpendicular to the reflecting surface. Either blotting paper or magnesium carbonate provide a rough surface that acts like a surface covered with myriads of tiny mirrors and they reflect the light in a multitude of directions. White plaster and other materials of this nature act in a similar manner and are extremely desirable for rooms or buildings in which well-diffused illumination is desired.

Heat-Treating of Steel Dies

C. S. Smith who is general foreman in a plant where steel-treating is done on a fairly large scale gives recommendations designed to determine time and temperatures. Applying his conclusions to actual dies of various sizes he claims that he is able to take any make of oil-hardening steel and treat it so that the results after hardening will be within plus or minus 0.002 in. No matter how well a piece of steel has been annealed, after forging it will have machining strains that should be removed by the pre-heating process. Failure to do this will often result in a cracked die. The practice that will give the best results with either oil-hardening or water-hardening steels is to have the furnace heated to a temperature of approximately 500 deg. F. and to raise the temperature of the die steel to the same point.

Another point brought out is that it is as easy to ruin a die during the drawing operation as it is during the heating up process, perhaps easier. It will also be remembered that the shrinkage of a die can be controlled to a certain point by the way it is quenched. For instance, a number of large dies of regular shape but having a large number of holes of various sizes were to be hardened and they were dipped in a manner that seemed the most reasonable. In spite of the unusual amount of shrinkage this method was adhered to for a long time till rather suddenly it became manifest that this was not the right way to do it. A change was made in the method of dipping and the shrinkage was reduced about 50 per cent. —*The Iron Age*, Sept. 3, p. 608.

American Machinist

Established 1877

KENNETH H. CONDIT AND FRED H. COLVIN, *Editors*

Immigration or Machinery?

SEVERAL years ago when the first restrictive immigration legislation had just been passed an article was published in "American Machinist" under the above title. The article endeavored to prove that the almost complete stoppage of immigration of the common labor type left wider use of labor saving machinery as the only recourse for the industrial employer.

An analysis of immigration figures just published by the Industrial Conference Board indicates that the actual condition in regard to the shortage of immigrant common labor is far more serious than was prophesied. As a matter of fact, many European countries failed to fill their immigrant quotas during the last year and in the case of the Southern European countries, more aliens left the United States than immigrants arrived. In other words, there was a net loss in the number of nationals of these countries for the fiscal year of 1924-25, a result that practically nobody had anticipated.

Evidently there is going to be a greater need for all kinds of machinery than was at first anticipated. This should be welcome news to the builders of mechanical equipment and it should stimulate them to renewed activity in the development of better devices and the reduction of manufacturing costs.

Organized labor will do well to withdraw its opposition to the use of machinery in the few trades where that formerly almost universal opposition still exists. Otherwise there is going to be such a shortage of labor within a few years that rising prices will force Congress to let down the immigration bars and bring about the very lowering of wage and living standards that the unions have fought so hard to raise.

Free Engineering Service

ENGINEERING service is probably the only professional advice in the world that is given away freely. The lawyer gets a retaining fee, usually in advance, and the doctor's bill comes in just the same if he kills or cures. But few think of paying for advice as to the best method of manufacturing any kind of a product even though the advice is based on experience that has been accumulated at great cost. And some concerns seem to seek opportunities to continue to give away this experience or even force it on indifferent buyers. Very frequently the salesman urges the possible customer to "let us send you a layout" when there isn't one chance in a hundred of making a sale.

These layouts and time studies cost the industry thousands of dollars each year, and while the successful bidder may get his money back, the cost to the rest of the industry makes a very considerable overhead that does not go into the machine or add to its value. Of course, the buyers pay in the end, unless the builder loses money, but the method is open to many abuses and is frequently an uneconomic expenditure.

No man should expect to get, or give, engineering advice for nothing. You pay the doctor even if you don't take his medicine, or the lawyer whether you take his advice or not. Why cheapen the engineering profession by giving, or expecting, advice based on years of experience, without proper remuneration?

The layouts and time studies may show that the present new methods are not enough better to warrant installing new machines. It is certainly worth a few hundred dollars to know that you need not invest thousands in new equipment. Plans that you may not use may well be worth paying for, if they prove that the one you adopt is better.

Engineering advice will be better appreciated when it demands remuneration in the same way as other professions. It has been on the free list long enough.

Just Suppose

JUST suppose a customer asks you to supply him with a chemical balance and to guarantee it to a certain degree of accuracy. You go ahead and submit figures assuming that he is going to mount it on a rigid foundation independent of the building in which it is located. You get the order and deliver the balance. A few weeks later your customer writes an angry letter to the effect that the balance is not as accurate as the guaranty calls for. Investigation shows that he has set it up on a wooden table in the corner of a busy factory department where the vibration would disturb the crudest kind of a scale, let alone a delicate instrument like a chemical balance. The upshot of the matter is that he insists on holding you to your contract and you have to put in for him a suitable foundation at considerable expense and you lose money on the deal. All because you guaranteed performance when you did not know all conditions.

Wouldn't it be a better world to do business in if no one made sweeping promises without being sure of what he was promising?

Just Suppose.

Shop Equipment News

Norton Semi-Automatic Grinding Machine Type B

The semi-automatic grinding machine, illustrated, is being built by the Norton Co., Worcester, Mass. It is substantially a Type-BA, special-purpose machine, with automatic controls added to reduce the number of motions required of the operator by an amount that will allow one man to operate two machines.

These motions, which involve starting and stopping of the work, the flow of grinding compound on the wheel and the continuous power in-feed with rapid traverse at the end of the cut, are all accomplished automatically by a cam, a piston and pneumatic valves.

A single lever, which can be seen on the front of the machine, in Fig. 1, is used to start the cycle of operations.

The machine is self-contained and carries two electric motors rigidly mounted, as can be seen in Fig. 2, a view taken from the rear. Power for the grinding wheel feed is supplied by a standard constant-speed motor bolted to the rear of the base. The work is revolved on dead centers by a headstock mounting a standard adjustable-speed motor. The main drive motor has been mounted, as shown, on the rear to make a choice of several standard motors available, thus making it easier to secure one promptly from a motor manufacturer's stock.

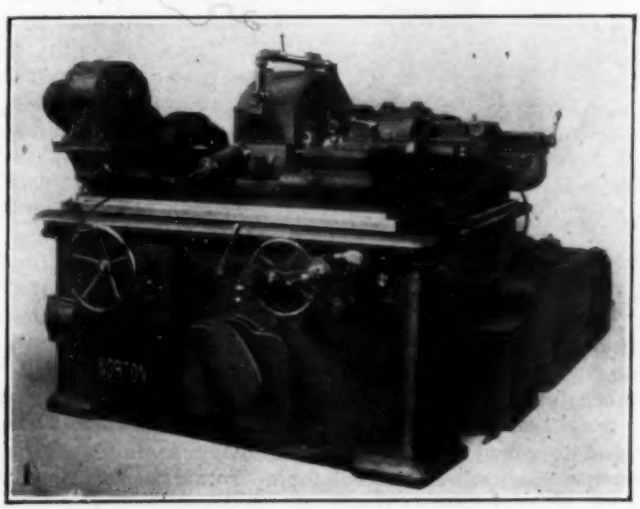
The micrometer-wheel feed is positively controlled by a cam which allows the wheelslide to move toward the work to a positive stop and to then automatically reverse, moving the wheel back from the work. The automatic cycle is started by the simple movement of a lever, leaving the operator free to prepare work for the machine or look after another machine while the work is being ground.

The cycle consists of starting the work revolution, turning on the flow of grinding compound, feeding the wheel toward the work to a positive stop, rapidly reversing the feed to back the wheel from the work, stopping the work revolution and shutting off the flow of compound. The rate of infeed which determines the time required for the cycle can be varied, to suit different materials being ground, by convenient change-gears on the front of the machine.

To remove the work from the centers, the operator steps on a foot pedal which operates a valve controlling an air piston in the footstock. The piston is double acting and serves to set the spindle up on the next piece of work as well as to remove it from a piece that has been finished, thus allowing the operator the use of both hands for removing a finished piece from the machine and for placing the next piece in position on the cradle. This cradle is at such a height that when the footstock center is moved forward, the work is lifted to swing clear.

The wheelslide is the regular Norton Type-B design with the improved spindle-bearing construction providing for adjustment while the spindle is running. A reservoir in the wheelslide supplies lubricating oil by a chain-driven pump to the spindle journal and thrust bearings. The stream of oil flowing on the bearings is visible to the operator through bull's eye glasses on the front of the wheelslide.

The base is of heavy construction to provide rigid support for the massive wheelspindle head and heavy type headstock and footstock. It rests on three points and requires no foundation but a good floor. The work tables are exceptionally low for the convenience of the operator in handling heavy work. Both headstock and footstock are pneumatically controlled. The work revolution is started and stopped automatically by the action of a cone clutch and brake



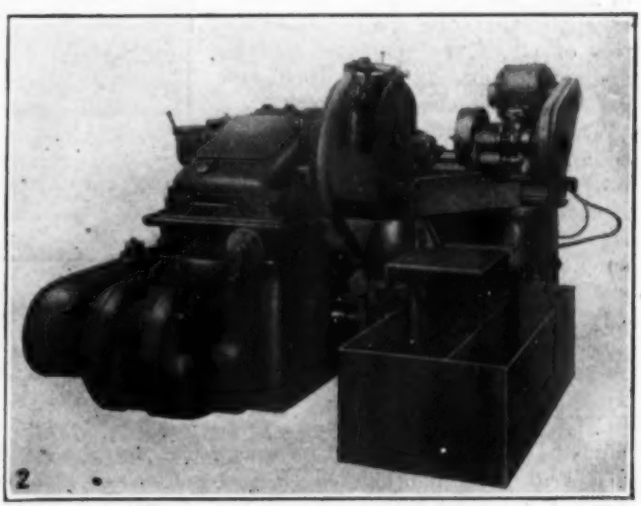


Fig. 1—Norton Semi-Automatic Grinding Machine, Type B. Fig. 2—A rear view of the machine

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actuated by the control lever, thus avoiding the necessity of starting and stopping the motor.

Grinding compound is supplied to the grinding wheel from a pump mounted on the main drive shaft. The pump tank and settling tank are placed on the floor at the rear.

The machine provides 12 in. of maximum swing over the swivel table and takes 18-in. lengths between centers, although it is contemplated that longer lengths of machines will be added. Wheels, 20 in. in diameter and up to 9-in. face, can be mounted, making the machine capable of taking cuts up to 9 in. long. The Norton wheelspindle reciprocating attachment, on the end of the wheel spindle, gives the grinding wheel an oscillating motion of ½ of an inch, a feature that is intended to reduce wheel wear and to produce a better finish, as well as to increase production. The machine is intended for the grinding of such work as medium sizes of outer rings for ball and roller bearings, short shafts with wide cuts, bushings and miscellaneous work within its capacity.

Oliver Automatic Drill Pointer

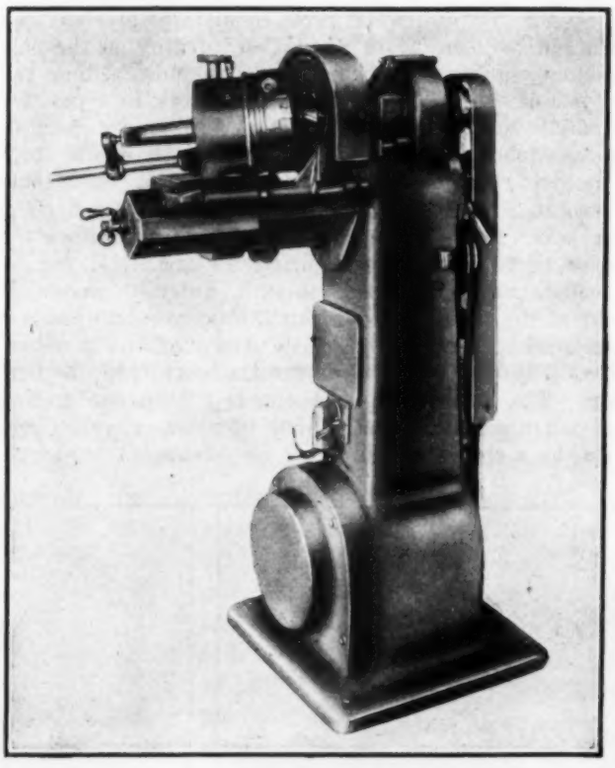
The automatic drill pointer illustrated is the result of four years of development on the part of the Oliver Instrument Co., Adrian, Mich., to improve the design of its original automatic machine which was put on the market in 1921 and was described on page 1144, Vol. 54 of the *American Machinist*.

The improvements have been aimed to simplify the mechanism and to increase the operating efficiency. They are based on the experience gained from many installations and on constructive criticism, of the large users as well as the manufacturers of twist drills, sought for by the company since making the first installation. The machine will produce an accurate, dependable and uniform drill point.

The improvements cover all details of the original machine and include, in general, greater speed, the ability to handle bent drills, a wider range of application, the complete protection of all of the bearings, modern methods of insuring lubrication, and greater convenience in operation.

The wheelspindle is carried in an eccentric quill in taper adjustable bearings designed on the Hendy-Norton principle. This bearing design together with the encircling eccentric bearing on which the clearance cam is mounted has eliminated any vibration and lost motion that could be detected in the original rocker arm and results in a polished finish on the drill point.

The drill holder has been redesigned and moved forward to secure the drill in a two-jaw chuck just back of the point rather than by the shank. Bends in the drills thus have no effect on the accuracy of the ground point. The bearing for this holder has been amply proportioned for the heaviest load that can be put upon it. The feed screw and nut are entirely inclosed and all points of the drill holder slides are protected by shields.



Oliver Automatic Drill Pointer

One of the two chuck jaws can be loosened by moving a set screw and can then be set out and shimmed for off-center grinding when such work is desired. The path of the drill, with reference to the wheel, has been altered to give a ground point slightly stronger at the cutting edge.

The lip rest has been provided with an operating handle, located below and back of the holder, to obviate any danger to the operator's fingers when setting up a drill.

The wheelguard has been redesigned to permit a direct flow of sparks and emery away from the machine. The emery-wheel dresser has also been relocated so it can be brought into working position and operated across the face of the wheel by turning the lead screw lever or can be set down, out of the way, below the holder. The operating handle has been relocated to bring it to the right-hand side convenient to the operator. It is used to stop the drill drive, to change drills, without shutting down the drive motor or stopping the wheel.

The drills are rotated continuously by means of a splined drive shaft between the drill holder and the drive in the base. The continuous motion results in approximately a 50 per cent increase in production and the construction of shaft and gearing eliminates the universal points originally employed for the intermittent rotating mechanism.

A geared pump in the base supplies lubricant under pressure from a tank to pour over the clearance cam and the main bearings at the top of the machine, to flood the cam-and-drill rotating-drive gears and to then return to the tank for recirculation.

The motor is mounted in the bottom of the base and drives by belt to the spindle pulley rotating it at 2,400 r.p.m. Another belt connects to the gear assembly inside the column to rotate the cam at 70 r.p.m. A spring-backed tightener maintains correct tension in the

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main drive belt and compensates for changing center distance between wheelspindle and motor as the eccentric rotates.

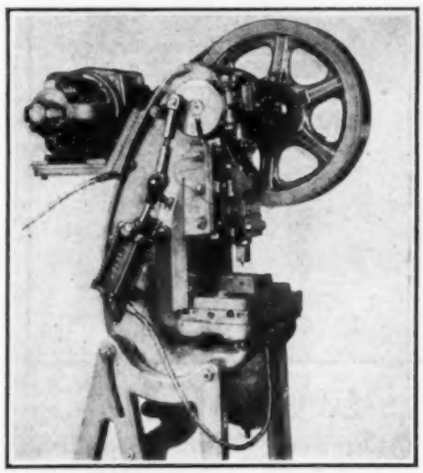
The company has prepared a chart which shows, graphically, a comparison between the torque and thrust required for ordinarily ground drills and those ground on the machine, at varying amounts of feed per revolution. The data for the chart was obtained by actual test and shows, distinctly, to the advantage of the results obtainable by the automatic drill pointer.

Logan Work-Ejecting Air Compressor

The Logansport Machine Co., 906 North Market St., Logansport, Ind. has added the work-ejecting air compressor, illustrated, to its lines of air operated devices. It is intended for attachment to punch presses and other types of machinery for ejecting the work, or for blowing scale and chips from the tools.

When the device is attached to a punch press, air is compressed in the cylinder on the down stroke of the ram and automatically released on the return stroke. The blast of air is regulated by a pet cock.

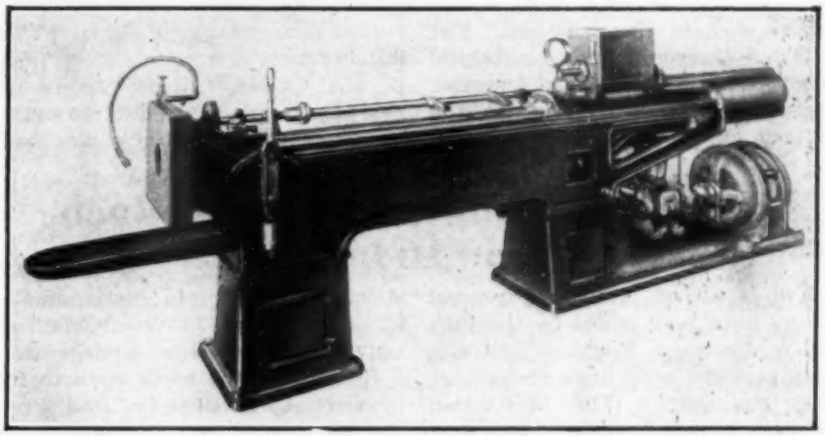
The cylinder is constructed of steel tubing and is regularly furnished with a 3-in. bore and 5-in. stroke. When operating at 60 strokes per min., it is said to deliver air at 60 lb. per sq.in. It can be furnished when specified as special at 4½-in. bore and 6-in. stroke.



Logan Work-Ejecting Air Compressor

Lapointe Hydraulic Broaching Machine, Type 4-W

The latest product of the J. N. Lapointe Co., located at New London, Conn., is the 4-W hydraulic broaching machine shown in the accompanying illustration. It is designed to handle all classes of work to which a broaching machine is adapted. Instead of a screw and revolving nut to operate the draw-rod, the latter is moved by the pressure of oil acting against the piston of a cylinder, which is 8 in. in diameter.



Lapointe Hydraulic Broaching Machine, Type 4-W

Oil fills the cylinder on both sides of the piston and also partly fills a reservoir above the machine. This reservoir is open to the atmosphere and the oil is there automatically freed from entrained air. To operate the cycle of the machine, the oil is merely transferred by the pump from one side of the piston to the other.

Though the oil level rises and falls regularly in the upper reservoir with the action of the machine, it is never out of sight in the glass gage before the operator. The fluctuation is caused by the presence in the cylinder of the draw-rod on one side of the piston, thus lessening its total capacity.

The energy to move the broach is supplied through the medium of a standard constant-speed, variable-stroke pump, made by the Waterbury Tool Co. The pump can be coupled direct to an electric motor mounted on the machine base or it can be driven by belt from any convenient overhead line. A 10-hp. motor is required. The maximum oil pressure recommended is 900 lb. per sq.in., corresponding to a dead-weight pull of 43,000 lb. on the draw-rod. The relief valves are set for this pressure. The actual pressure of the oil, when the machine is at work, is in direct proportion to the load imposed by the broach and is, at all times, under the observance of the operator by means of a standard pressure gage.

The rate of travel, imparted to the broach, is variable from zero to 24 ft. per min., and is under instant control. The return speed is at a fixed rate of 60 ft. per min., but this can also be governed at will by means of the hand control. The maximum available stroke is 64 in., but the range can be set to suit the job by means of an automatic reversing dog, secured by a spring-and-plunger lock, that is adjustable along the bed. A wrench is not required to loosen or to set it.

When a broach is started in the work, the oil pressure instantly rises to the point necessary to move it and remains stationary at that pressure as long as the work upon the broach is constant. Should a broach become dull gradually, as it inevitably will in service, the progressively-rising pressure of the oil, as indicated by the gage, keeps the operator informed as to its condition. Should the load increase beyond the safe limit for the broach in use, the pump will automatically be thrown out of action and the machine will remain stationary until

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the trouble indicated is remedied.

This feature also protects the machine from possible injury on the return stroke, for should the ram meet with any obstruction to its movement it will stop at once without doing any damage. The high speed of the return is made possible without increasing the delivery of the pump by the fact that the actuating cylinder in this case is the hollow shell of the draw-rod. The space in the main cylinder, behind the piston, is merely added reservoir capacity, the pump transferring the oil from one side of the piston to the other as the latter moves along the cylinder. A study of this condition will show at once why there is so little fluctuation in the oil level at the upper reservoir.

The opening in the stationary faceplate is 5 in. in diameter. The drawhead is normally centered with this opening, but is provided with a vertical adjustment of 1⅛ in. in either direction. The machine occupies a floor space of 25 in. by 15 ft., and weighs approximately 7,600 pounds. A No. 3, Brown & Sharpe, geared pump is included in the equipment to supply lubricant and coolant.

Carroll & Jamieson Lathes, 15-Inch and 16-Inch

Two sizes of lathes, 15-in. and 16-in., have been added by the Carroll & Jamieson Machine Tool Co., Batavia, Ohio, to its lines of machine-shop equipment. The illustration shows a geared headstock, but they can be furnished when so desired with a cone-head drive.

The bed is of heavy construction without openings in the side, and is provided with heavy box girts set at close intervals.

The geared headstock contains combinations for 12 selective speeds ranging from 11½ to 393 r.p.m. The gears are made of chrome-nickel steel forgings and are heat-treated. The teeth are cut 8 pitch, stub form. The shafts are made of special steel and are ground to fit in bronze bearings.

The spindle is also of special steel ground to run in bronze bearings which are hand-scraped. Thrust is taken on a ball-thrust bearing. Lubrication is by the splash system with special oilers provided for the spindle bearing. A friction clutch and brake, both operated by one lever, give instant control for the spindle movements. Changes of speed can be made without stopping a cut, while the design prevents engaging two speeds at once.

The carriage is provided with a special clamp, conveniently placed to secure it to the bed when facing work is being done. Felt-packed brass wipers protect the sliding bearings. The cross-slide and compound rest are fitted with adjustable taper gibs. The cross-feed screw and the compound-rest screw have micrometer dials reading in thousandths of an inch. The compound-rest swivel is graduated to 360 degrees.

General cutting feeds are actuated by a splined shaft so the lead screw can be reserved for thread cutting. The two are interlocked and are provided with reversing levers.

The apron is of the double-wall type and supports the gear studs on both sides. A thread indicator is included in the apron assembly.

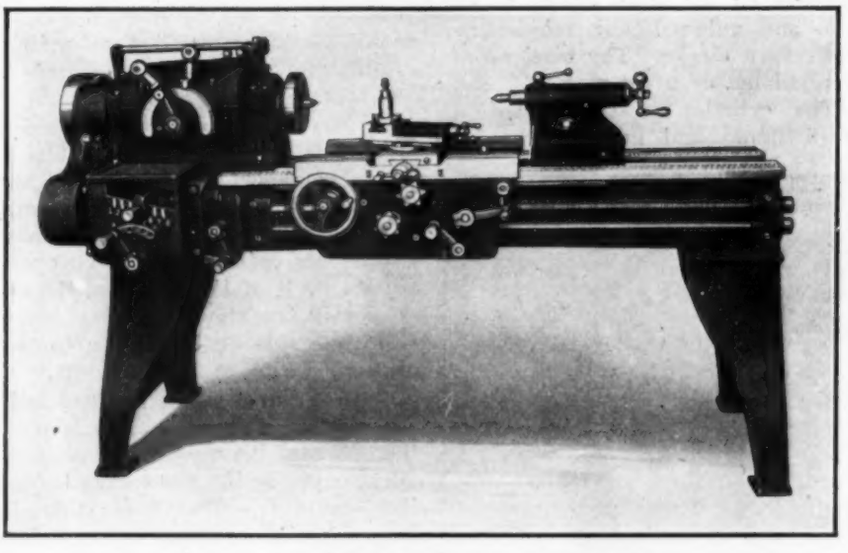
The quick-change gear box is constructed as a single unit, and all combinations of feed are obtained through two levers. The gears are made of steel, cut from the solid. The shafts run in bronze bearings. Threads of 3 to 46 per inch can be obtained direct, and a quadrant accommodates gears to cut any other special pitches. A tumbler is provided to set for right- or left-hand threads.

A feature of the design is the method of assembling the gear box and the lead-screw block. They are bolted to a machined pad on the side of the bed, in which a master slot is cut to take a key on the parts. This locates them accurately and makes stock parts interchangeable.

The tailstock is of the cut-away, set-over type. The sleeve is made of special steel ground to fit. The center is self-discharging. The binder is of the floating type, having no effect on alignment when the spindle is locked by means of it.

Motor drive is arranged by mounting the motor in a cabinet leg and belt-connecting it to the drive pulley. The belt drive is guarded. A 2-hp., 1,150-r.p.m. motor is recommended for either size.

Equipment regularly furnished includes faceplate, chuck plate, steady-rest, follow rest, countershaft on belt-driven machines, centers, wrenches and thread indicator.



Carroll & Jamieson Geared Head Lathe

Attachments which are available to specification include taper work, milling and keyway cutting, draw-in arrangement with collet and a turret for the carriage. A Metric screw and gearing are also obtainable.

The lathes will swing 15¼ and 16¼ in. over the bed, and 10⅜ and 11⅜ in. over the carriages on the two sizes respectively. The diameter of the front journal is 2⅞ in., and the

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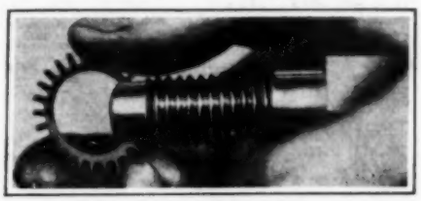
length is 4⅜ in. The length of the carriage bearing is 23⅜ in. The cross slide is 6⅜ in. wide.

The maximum distance between centers on a 6-ft. bed is 38 in. There is a 1¼-in. hole through the live spindle. Morse taper is used. The drive shaft rotates at 250 r.p.m.

Beds are available in 6-, 8-, 10-, 12- or 14-ft. lengths. The weights with a 6-ft. bed are 1,800 lb. and 2,000 lb. respectively.

Illinois Tools Works Lockwasher

A lockwasher, which consists of a thin ring of hardened steel with a series of prongs on its outer edge, is being manufactured by the Illinois Tool Works, 2501 North Keeler Ave., Chicago, Ill. The prongs or teeth are slightly upset so, when pressed between a metal surface and the nut,



Illinois Tool Works Lockwasher

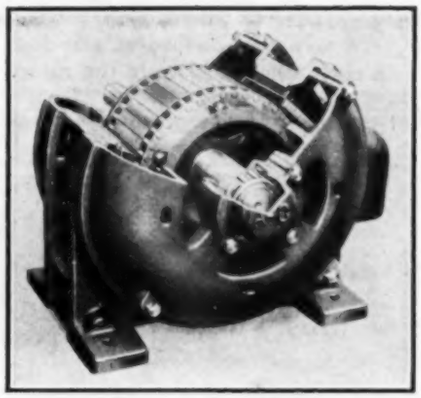
they will dig into the softer metal and assist in preventing the nut from backing off.

The washers are made in all sizes and are recommended by the company for all classes of machinery and for application, as well, in the automotive field and in railroad and structural work.

Allis-Chalmers Anti-Friction-Bearing Induction Motors

The Allis-Chalmers Manufacturing Co., Milwaukee, Wis., has placed a complete line of 25- and 60-cycle, squirrel-cage and slip-ring, induction motors, in ratings up to 200 hp., on the market after two years of experimental and development work. The line is equipped with Timken tapered roller bearings, mounted in dust-proof and grease-tight housings and packed in grease, so that further lubrication is required only at infrequent intervals.

The bearings are mounted with a light press-fit for both the cone and



Allis-Chalmers Anti-Friction-Bearing Induction Motors

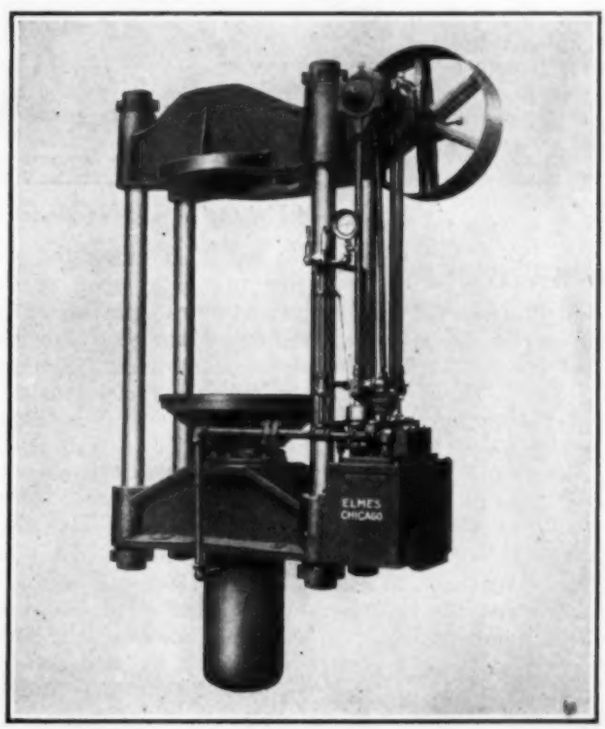
the cup and do not require the use of a locknut or other means of holding the races in place. The design also facilitates removal.

In addition to the bearings, special attention has been given to the design of the motors themselves. The frame is made of steel with the feet cast integral. The coils are thoroughly insulated, impregnated with water-proof varnish and baked. The openings in the housings and frames for ventilation are placed in vertical planes so that falling objects cannot enter the motor. A fan on the rotor sets up a current of air.

The line has been thoroughly tested on drives for the other lines manufactured by the company. The motors have had to meet conditions of moisture when driving Allis-Chalmers centrifugal pumps in service. They have been installed in saw mills, flour mills and cement mills where dust is a serious problem. They have been used to drive crushers, grinders and other machinery by belt, and by chain and through gears and couplings for an extended length of time.

Elmes Tire-Applying Presses, 325-Ton

The Charles F. Elmes Engineering Works, 1001 Fulton St., Chicago, Ill., has added the tire-applying presses Nos. 2664 and 2699 to its lines of hydraulic equipment to meet the needs of the trade for a press to accommodate increasing tire sizes.



Elmes Tire-Applying Press No. 2664

The principal feature of the press No. 2664 illustrated is in the pumping unit, which comprises three high-pressure plungers and one large low-pressure plunger. The low-pressure plunger is equipped with an automatic cutout, so that the pump delivery is by-passed when the heavy pressure point is reached in the travel of the ram. It remains by-passing during the completion of the high-pressure cycle and until the ram is again ready to move upwards. It is then put in action by moving a secondary lever which is located below the main operating valve.

In the press No. 2699, this low-pressure arrangement is not included, and all press movements are actuated by the three-plunger, high-pressure pump and the combination valve.

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The design of the presses follows closely on the company's standard line. The cylinder-throat bore is long to accurately guide the ram. The moving platen is of heavy construction and is machined with circular grooves to assist in locating the work. The design permits of rotating the platen so the work can be examined in all positions. The press movement is controlled by the company's standard type of combination safety and release valve.

The pump plungers are made of alloy steel, which is hardened and ground to run in bronze-fitted stuffing boxes. The boxes are designed for fibrous packing, and are arranged so the packing can be renewed without removing the plungers. The pump cylinder is machined from a solid steel forging and is fitted with renewable bronze valve seats.

Both of the models are of 325-ton capacity. The strokes are 36 in. On the No. 2664 press, the maximum opening between platens is 52 in., and on the No. 2699 press is 50 in. The platen measures 41 in. in diameter, the upper one having a circular opening 24 in. in diameter. The bottom platen center hole measures 14½ in. in diameter.

There is 45 in. in the clear between uprights. A 7½-hp. motor is recommended. Press No. 2664 stands 12 ft. 6 in. in height, occupies a floor space of approximately 7 ft. x 4 ft. and weighs 14,300 lb. without the motor. Corresponding figures for press No. 2699 are 12 ft. 3 in. in height, 7 ft. x 4 ft. for floor space and 13,160 lb. in weight.

Hercules Portable Air Tools

The portable air tools illustrated are being manufactured by the Buckeye Portable Tool Co., 135 Wayne Ave., Dayton, Ohio. They are intended for drilling, grinding, buffing and similar operations where portable tools can be used.

In Fig. 1 is shown one of the drills disassembled, and in Fig. 2 is a view of one of the grinders. The essential difference between the two lies in the gear reduction and the offset position of the drill spindle.

A diagram is given in Fig. 3 to illustrate the principle of operation. Air enters from the line through the three ports *A*, *B* and *C* near the center of the rotor and fills the three passages back of the blades *D*, *E* and *F*. These blades are set at 120 deg. with each other in slots in the rotor. Each port connects to one passage which supplies pressure back of one blade. A smaller passage from each port communicates to the slot below the blades to hold them out against the casing.

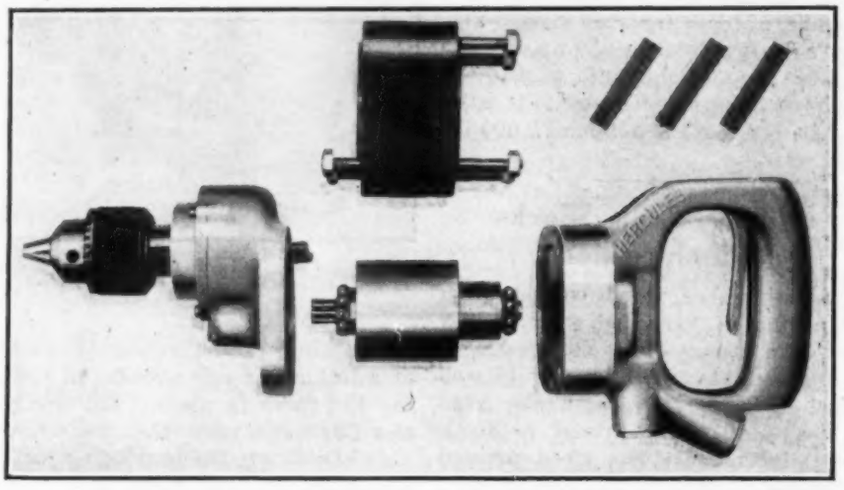


Fig. 1—Hercules Portable Air Drill

In the casing there are two exhaust ports set at 180 deg. with each other, the air traveling around from these ports as it is exhausted to emerge from the outer shell at *G*. The inlet ports are controlled to register and cut off successively with two inlets from the supply coming through the stationary end-housing.

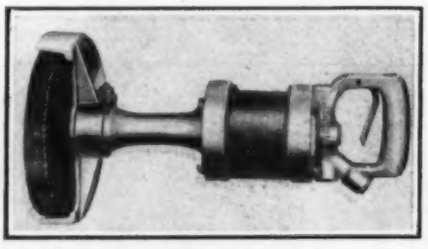


Fig. 2—One of the Hercules Grinders

In the position shown, air is being admitted through *A* to exert pressure back of blade *D*. It is cut off from *B*, and the corresponding blade *E*, having passed one of the exhaust ports, is permitting the air back of it to escape. The air supply is also cut off from *C*, this cutoff occurring very shortly after the inlet and the port register, but the air, under pressure, is confined behind the blade *F* and is doing useful work by expansion. This expansion continues until *F* passes the next exhaust port. The arrangement of inlet and exhaust is such that on each complete revolution each blade will receive two impulses, go through two periods of expansion and will exhaust twice.

The tools, of varying sizes, are proportioned to conform to the work that each is expected to do. There are three sizes of drill, a No. 00, a No. 0 and a No. 1, with capacities, respectively, up to $\frac{7}{16}$-, $\frac{3}{8}$-, and $\frac{5}{8}$-in. drills. Corresponding speeds of rotation are 1,800 r.p.m., 1,200 r.p.m. and 700 r.p.m. The weights are 7 lb., 8 lb. and 13½ lb. The smaller two are equipped with chucks, while the larger can be furnished with a chuck or a No. 1 Morse taper socket.

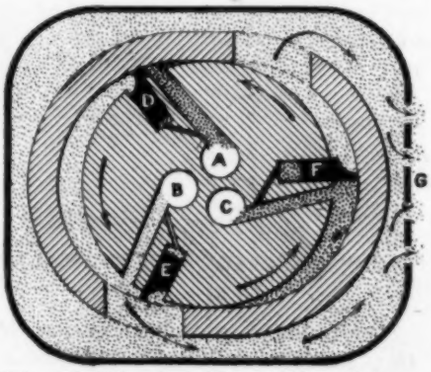


Fig. 3—Diagram Illustrating Operation Principle

There are four grinders, a No. 20, a No. 6, a No. 7 and a No. 11, with capacities, respectively, for wheels measuring 4 x ¾ in. at 6,000 r.p.m., 8 x 2½ in., buffing, at 6,000 r.p.m., 6 x 1 in. at 4,000 r.p.m. and 8 x 1 in. at 3,600 r.p.m. The corresponding weights are 7 lb., 10½ lb., 12 lb. and 14 pounds.

News of the Week

Steel Treaters Surpass Former Successes at Convention and Exposition

One hundred and eighty exhibits—Attendance 40,000—R. M. Bird nominated to succeed W. S. Bidle as president—Next year's meeting in Chicago H. H. Lester awarded Howe medal

AGAIN the American Society for Steel Treating has broken its records for successful expositions. At the seventh annual exposition, held in the Cleveland Public Auditorium, Sept. 14 to 18, inclusive, the entire available space was taken up by 180 exhibitors. Seventy-five machine tool builders had machines in operation, many of them on production work. It is estimated that the value of the exhibits was $2,000,000. It is reported that many sales were made, some of them during the first day.

To say that an exposition is the greatest of its kind ever held is a sweeping statement. Nevertheless it is a statement that was made by many of the exhibitors, some of whom have been showing their equipment in expositions for many years. Certain it is that the steel show was a great success from the viewpoint of the dissemination of information on modern equipment. The entire exposition pointed out, to the man who will observe, the futility of attempting to compete in the production world, without replacing his obsolete equipment.

There were approximately 5,000 registrations, which included the names of members of the society, their guests and exhibitors. An accurate count of all visitors entering the doors is almost impossible. Many individuals will, of course, pay several visits. A careful estimate places the total attendance at between 40,000 and 45,000.

The technical sessions of the convention maintained the high standard set at previous conventions. The members of the society are hard workers. They deal with highly technical subjects and the preparation of papers requires an enormous amount of work. The length of the program and the nature of the papers, the titles of which are given elsewhere in this report, indicate that effort was not spared in this year's work.

R. M. Bird for President

R. M. Bird, vice-president of the George F. Pettinos Co., Inc., Philadelphia, was nominated to succeed W. S. Bidle as president. For vice-president, J. Fletcher Harper, research engineer, Allis-Chalmers Manufacturing Co., Milwaukee, was nominated. Zay Jeffries, chief of research, the Aluminum Co. of America, was named to succeed himself as treasurer. W. H. Eisenman, 4600 Prospect Ave., Cleveland, will continue as secretary. The nominees for directors for two years were R. G. Guthrie of the Peoples Gas, Light and Coke Co., Chicago, and Hyman Bornstein of Deere & Co., Moline, Ill.

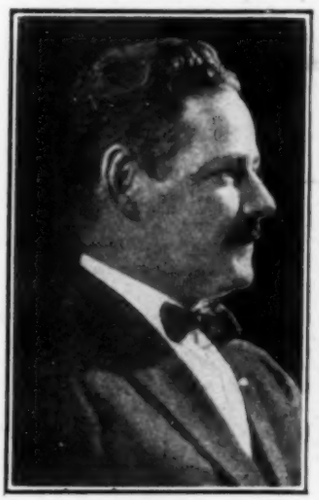
The eighth annual convention and exposition will be held on the Municipal Pier, Chicago, September 20 to 24, inclusive, 1926.

Three general classifications may be given to the equipment exhibited: Fabrication, or production; heat-treating; and inspection. A more detailed classification shows that these kinds of equipment were on the floor: machine tools, cutting tools, small tools, steel and steel products, alloys, welding and cutting equipment, gas appliances, all types of furnaces, insulating materials, fire brick, rock products, instruments for measuring, testing and recording, salts, compounds, heat-enduring materials, lights, burners, castings, automatic furnace controls, cleaning materials, speed transformers, pots, retorts, forgings, belting, dies, lubricating systems, portable elevators and stackers, gears, testing machines, sandblast equipment, air compressors, turbines, cutlery and others.

As usual, a number of prominent visitors from abroad were present. They included men from England, France, Japan, Germany, Czecho-Slovakia, Mexico, South Africa.

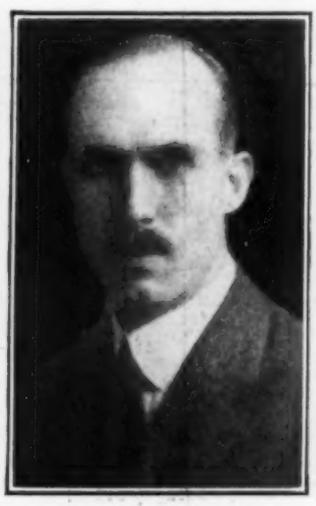
H. A. Schwartz, chairman of the Cleveland chapter, opened the convention by extending a welcome from the Cleveland chapter. Col. J. B. Dillard, General Chairman, also welcomed the delegates, and W. S. Bidle, president, of the society, responded.

The Cleveland chapter provided splendid programs of entertainment for both members and ladies. Plant inspection



W. H. Eisenman

Zay Jeffries



J. Fletcher Harper

R. M. Bird

included trips to the works of the Ohio and Western Pennsylvania Dock Co., the National Carbon Co., the White Motor Car Co., the Cleveland Electric Illuminating Co., the Nela Park plant of the General Electric Co., and the Cuyahoga plant of the American Steel and Wire Co.

Tuesday evening was enlivened by the annual smoker. The annual banquet was held Thursday evening. W. R. Hopkin, city manager of Cleveland, was the speaker.

At the annual business meeting W. S. Bidle, president, reviewed the progress of the organization during the past year. W. H. Eisenman, in the annual report of the secretary announced a membership of 3,360 as of Aug. 31, a gain of 11 per cent over the membership of last year. The membership is distributed in 29 chapters, which held 224 meetings throughout the year with a total attendance of 25,000.

Mr. Eisenman reported that the finances of all chapters are in good condition. He commented briefly on the work of the recommended practice committee, stating that to date the society has issued 243 pages of data sheets, covering 38 subjects. Of this number, 135 pages covering 24 subjects have been issued during the past year.

H. H. Lester, director of research, Watertown Arsenal, was awarded the Howe medal for his paper, "The X-Ray and Its Relation to Foundry Practice."

Charles F. Brush, scientist and inventor, of Cleveland, was elected an honorary member of the society.

During the convention there was a symposium on hardness testing and another on metallurgical education.

The work of the hardness-testing committee of the National Research Council has recently been turned over to the A.S.S.T. The same committee that accomplished excellent results under the National Research Council will continue the work with the A.S.S.T.

The symposium on metallurgical education showed great interest on the part of the A.S.S.T. members. The speakers were Dr. A. E. White, director of the department of engineering research of the University of Michigan, L. W. Wallace, executive secretary of the American Engineering Council, Prof. H. M. Boylston of Case School of Applied Science, and C. E. Skinner of the Westinghouse Electric and Manufacturing Co. The speakers pointed out the need for technically trained men. President Bidle was authorized to appoint a committee to report on the educational needs of the steel industry.

A paper that was of especial interest was read by H. A. Schwartz, of the National Malleable Castings Co., Cleveland. It dealt with the calculations necessary in determining the time required for annealing malleable-iron castings and for determining whether or not materials can be annealed.

The following papers were presented during the convention: "Interpretation of Notched Bar Impact Test Results," by Paul Heymans, Massachusetts Institute of Technology, Cambridge, Mass.

"Chemical Composition of Tool Steels," by J. P. Gill and M. A. Frost, Vanadium Alloys Steel Co., Latrobe, Pa.

"Experiments with Nickel Tantalum, Cobalt and Molybdenum in High Speed Steels," by H. J. French and T. G. Digges, Bureau of Standards, Washington, D. C.

"Effect of Cold Work on Endurance and Other Properties of Metals," by D. J. McAdam, Jr., U. S. Naval Engineering Experiment Station, Annapolis, Md.

"Graphitization at Constant Temperature," by H. A. Schwartz, National Malleable & Steel Castings Co., Cleveland, Ohio.

"Some Factors Affecting Coercive Force and Residual Induction of Some Magnet Steels," by J. R. Adams and F. E. Goeckler, Midvale Co., Nicetown, Philadelphia.

"Proportion of Heat-Treated Steel to Total Production," by C. J. Stark, *Iron Trade Review*, Cleveland, Ohio.

"Acid Open Hearth Steel," by Radclyffe Furness, Midvale Co., Nicetown, Philadelphia.

"Basic Open Hearth Steel," by Edward Whitworth, Bourne-Fuller Co., Cleveland, Ohio.

"Electric Furnace Steel," by F. T. Sisco, McCook Field, Dayton, Ohio.

"Comparative Slow-Bend and Impact Notched Bar Tests on Some Metals," by S. N. Petrenko, Bureau of Standards, Washington, D. C.

"Effect of Reheating on Cold Drawn Bars," by S. C. Spalding, Halcomb Steel Co., Syracuse, N. Y.

"Application of the Mathematics of Probability to Experimental Data as a Basis for Appropriate Choice of Ferrous Materials," by B. D. Saklatwalla and H. T. Chandler, Vanadium Corporation of America, Bridgeville, Pa.

"Retained Austenite—A Contribution to the Metallurgy of Magnetism," by Dr. J. A. Mathews, Crucible Steel Company of America, New York City.

"On Martensite," by Dr. H. Hanemann, Technischen Hochschule, Charlottenburg, Germany.

"The Carbon Content of Pearlite in Iron Carbon Alloys Containing One per Cent Silicon," by Anson Hayes and H. U. Wakefield, Iowa State College, Ames, Iowa.

"Irregular Carburization—Its Causes and Preventions," by W. J. Merten, Westinghouse Electric & Manufacturing Co., East Pittsburgh.

"A Study of Dendritic Structure and Crystal Formation," by Bradley Stoughton and F. J. G. Duck, Lehigh University, Bethlehem, Pa.

"Oil Burning Equipment for Industrial Furnaces," by M. H. Mawhinney, General Furnace Co., Pittsburgh, Pa.

"Initial Temperature and Mass Effects in Quenching," by H. J. French and O. Z. Klopsch, Bureau of Standards, Washington, D. C.

"On the Nature of Some Low-Tungsten Tool Steels," by M. A. Grossman, United Alloy Steel Corporation, Canton, Ohio, and E. C. Bain, Union Carbide & Carbon Research Laboratories, Long Island City, N. Y.

"Effect of Cold Working on Hollow Cylinders," by Dr. F. C. Langenberg, Watertown Arsenal, Watertown, Mass.

"Modern Surface Grinding," by H. K. Spencer, Blanchard Machine Co., Cambridge, Mass.

"Dies," by S. A. Keller, Keller Mechanical Engineering Corporation, Brooklyn, N. Y.

"Elastic Ring for Verification of Brinell Hardness Testing Machines," by S. N. Petrenko, Bureau of Standards, Washington, D. C.

"Some Comparisons between Rockwell and Brinell Hardness," by R. C. Brumfield, Cooper Union, New York City.

"Hardness and Toughness of High Speed Steel as Affected by the Heat Treatment," by R. K. Barry, Barry Co., Muscatine, Iowa.

"Stress-Strain Curve and the Characteristics Which Are Associated with Hardness," by H. P. Hollnagel, General Electric Co., West Lynn, Mass.

"English Hardness Testing Machine of the Brinell Principle," by O. W. Boston, University of Michigan, Ann Arbor, Mich.

"The Durometer—An Instrument for Testing Hardness," by Dr. Albert Sauveur, Harvard University, Cambridge, Mass.

"Carburization by Solid Cements," by W. E. Day, Jr., International Motor Co., New Brunswick, N. J.

"Dilatometric Method of Heat Treatment," by O. E. Harder, R. L. Dowdell and A. C. Forsythe, University of Minnesota, Minneapolis, Minn.

"What Happens When Metal Fails by Fatigue," by Prof. H. F. Moore, University of Illinois, Urbana, Ill.

"Why Metal Warps and Cracks," by J. F. Keller, Purdue University Lafayette, Ind.

"Design and Operation of Furnaces for Salt Baths," by Sam Tour, Doehler Die Castings Co., Batavia, N. Y.

"Welding Steel Tubing and Sheet with Chromium-Molybdenum Welding Wire," by F. T. Sisco and H. W. Boulton, McCook Field, Dayton, Ohio.

Several of the papers, of more particular interest to the machinery industries were printed in abstract form in last week's issue of the *American Machinist*.

Many Machine Tool Exhibitors

Among the exhibitors, whose products are of particular interest to the machinery industries, and their representatives, were these:

Abrasive Machine Tool Co., E. Providence, R. I.; K. B. MacLeod, N. D. MacLeod.

Acme Machine Tool Co., Cincinnati; C. Meier, Mr. Stehn.

Air Reduction Sales Co., New York City; G. F. Weiser, W. F. Cooper, J. H. Gjerdum, C. E. Hobbs.

Ajax Manufacturing Co., Cleveland; J. R. Blakeslee, H. D. Heman, A. L. Guilford, Gordon Fristoe, W. W. Criley, J. A. Murry.

Charles G. Allen Co., Barre, Mass.; Harding Allen, C. G. Allen.

American Gas Furnace Co., Elizabeth, N. J.; P. C. Osterman, W. H. Kelsey, John Mehrman, Theodore Farwick, Sr., Gustav Schwab.

American Resistor Co., Philadelphia; J. A. Steinmetz, W. W. Perkins, W. E. Duersten, B. G. Tarkington, Oscar Brophy, H. N. Shaw, K. E. Rogers.

American Stainless Steel Co., Pittsburgh; J. C. Neale, C. S. Bunting.

American Tool Works, Cincinnati; J. C. Hussey.

B. C. Ames & Co., Waltham, Mass.; Warren Ames.

Anchor Drawn Steel Co., Latrobe, Pa.; D. R. Wilson, G. W. Morrison, W. W. Noble.

Armstrong-Blum Manufacturing Co., Chicago; H. J. Blum.

Armstrong Cork and Insulating Co., Pittsburgh; J. T. Gower, P. W. Adams, N. P. Waite, J. A. Wilson.

E. C. Atkins & Co., Indianapolis; E. S. Norvell, H. L. Pruner, A. Mertz, W. R. Chapin, William Appel.

Atlas Alloy Steel Corporation, Dunkirk, N. Y.; A. F. Dohn, F. B. Lounsberry, C. P. Burgess, Walter Bould, W. H. Wills, D. G. Hoyt, W. H. White, J. S. Marlowe, J. E. Jones.

Avey Drilling Machine Co., Cincinnati; J. G. Hey, J. Mirrielees, Mr. Hazeldine, L. B. Patterson.

Badger Tool Co., Beloit, Wis.; E. B. Gardner, John Nielson.

Baker Brothers, Toledo, Ohio; H. Tigges, William Baker, W. W. Elliott, G. E. Hallenbeck.

John Bath & Co., Inc., Worcester, Mass.; John Bath, J. C. Bath.

Bausch & Lomb Optical Co., Rochester, N. Y.; W. L. Patterson, I. L. Nixon, H. L. Shippy, F. C. Lau, L. V. Foster.

Bellevue Industrial Furnace Co., Detroit; W. E. Hinz, L. J. Raymo.

Bellis Heat Treating Co., Branford, Conn.; A. E. Bellis, W. E. Hitchcock, G. C. Davis.

Bethlehem Steel Co., Bethlehem, Pa.; H. G. Walton, D. A. Barkley, R. MacDonald, C. E. Chamberlain, F. W. Baldwin, T. J. Fitzgibbons, R. S. Tucker, W. C. Cutler, J. C. Chandler, P. Kreulin, A. D. Smith, A. P. Spooner, Robert Shimer, Walter Trumbauer, H. Wysor, A. D. Shankland, G. A. Richardson.

Billings & Spencer Co., Hartford, Conn.; J. J. Trapp, Howard Oberg, W. Roy Moore.

Bilton Machine Tool Co., Bridgeport, Conn.; E. A. Harper.

Black & Decker Manufacturing Co., Towson, Md.; S. D. Black, R. W. Procter, W. C. Allen, R. D. Black, G. M. Buchanan, R. E. Mizener, C. M. Hall, T. C. Cornell, W. J. Fenwick.

Blanchard Machine Co., Cambridge, Mass.; H. F. Skillings, C. L. Jones.

Bristol Co., Waterbury, Conn.; H. L. Griggs, C. W. Bristol, R. M. Walker, H. W. Moss, L. G. Bean, C. C. Eagle, H. G. Hall, H. E. Bean.

Brown Instrument Co., Philadelphia, Pa.; R. P. Brown, G. W. Keller, C. L. Simon, M. M. Watkins, R. W. Mayer, G. D. Clapper, D. C. Mayne, W. E. Woodrow.

Brown Lynch Scott Co., Monmouth, Ill.; J. A. Scott, W. B. Lynch.

Brown & Sharpe Manufacturing Co., Providence, R. I.; J. H. Skelton, William Spencer, J. G. Swinburne.

Buffalo Forge Co., Buffalo, N. Y.; E. G. Leonard, G. H. Zimmer, A. T. Yates, R. L. Pope.

Bullard Machine Tool Co., Bridgeport, Conn.; James Welsh, Joe Bullard.

Bureau of Standards, Washington; F. J. French, O. Z. Klopsch, T. G. Digges, H. S. Rawdon.

Andrew C. Campbell, Inc., Bridgeport, Conn.; Stuart Naramore, J. Johnson.

Carborundum Co., Perth Amboy, N. J.; J. A. King, C. A. Dutton, R. S. Baker, S. A. Feno.

Carpenter Steel Co., Reading, Pa.; F. A. Bigelow, J. H. Parker, C. A. Heil, J. N. Clarke, F. W. Curtis, F. G. Davis, V. W. Gardner, F. R. Palmer, W. H. Kemper.

Case Hardening Service Co., Cleveland; W. C. Bell, E. J. Gossett, J. S. Ayling.

Celite Products Co., Los Angeles; M. L. Jenkins.

Central Steel Co., Massillon, Ohio; F. J. Griffiths, B. F. Fairless, J. M. Schlendorf, W. M. Garrigues, D. B. Carson, G. F. Hess, F. L. Gibbons, Arthur Schaeffer, T. B. Davies, E. C. Smith, C. P. Richter, William Leffer, A. J. Wilson, M. M. Clark, R. K. Bowden.

Chesterfield Metal Co., Detroit, Mich.

Cincinnati Bickford Tool Co., Cincinnati; N. C. Schauer, R. M. Husband, S. K. Walker.

Cincinnati Milling Machine Co.; Walter Tangeman, J. E. Caster, L. V. Johnson, Walter Stegner.

Cincinnati Planer Co., Cincinnati; B. B. Quillen, George Langen, Carl Linden, George Lamoth, Tom Addison.

Cincinnati Shaper Co., Cincinnati; H. S. Robinson, George Diehl.

Cleveland Automatic Machine Co., Cleveland; H. W. Rupple, H. M. Rich, A. W. Schaffer.

Cleveland Tool and Supply Co., Cleveland, Ohio; T. C. Whitney, J. A. Abbott, J. A. Camm, J. Reedy.

Cleveland Twist Drill Co., Cleveland; H. G. Smith, Thomas Thomas, F. A. Kelly, R. D. Boltey, F. M. Hoelzle, A. J. Ireland, H. S. White, C. G. Franz, W. E. Caldwell, H. P. Jenson, J. B. Dillard, H. J. Baier, D. H. Burdett.

Colonial Steel Co., Pittsburgh; J. Trautman, Jr., N. B. Hoffman, F. L. Stevenson, Herbert Bray, Charles Kopenhoefer, W. H. Rieger, Messrs. Hamilton, Hill, Largey, McKinnon.

Crucible Steel Co. of America, New York City; E. C. Collins, Dr. J. A. Mathews, A. T. Galbraith, R. Michener, F. E. Phelps, R. C. Webster, J. W. Taylor, M. S. Dravo, B. F. Altman, A. H. Kingsbury.

Davenport Machine Tool Co., Rochester, N. Y.; Messrs. Thomas, Dresser.

Davison Gas Burner & Welding Co., Pittsburgh; N. C. Davison, Edward Poor.

Dearborn Chemical Co., Chicago; E. M. Converse, C. I. Loudenback, E. H. Ruhlman.

Henry Disston & Sons, Inc., Philadelphia S.; H. Disston, G. Satterthwaite, D. W. Jenkins, Mr. Forrest, H. B. Allen, J. Dorrington, E. Ludy, C. H. Williams, C. T. Evans, S. T. Harleman, Norman Bly.

Donner Steel Co., Buffalo, N. Y.; W. F. Vosmer, F. R. Huston, J. A. Buell, C. A. Cherry, E. D. Pumphrey, H. C. Richardson, J. W. Donner, R. E. Sherlock.

Driver-Harris Co., Harrison, N. J.; G. A. Lennox, W. E. Blythe, Messrs. Waldrip, Prior, H. D. Tietz.

Electro Alloys Co., Elyria, Ohio; A. M. Miller, Jr., E. C. White, W. J. Hansen, R. C. Culver, W. C. Whyte, J. B. Thomas, A. L. Garford, J. W. Henry.

Electric Furnace Co., Salem, Ohio; R. F. Benzinger, E. T. Cope, F. J. Peterson, A. H. Vaughn.

Electrical Refractories Co., East Palestine, Ohio; F. E. Owen, C. W. Williams, F. C. Simms.

Charles Engelhard, Inc., New York City; H. DeGallaix, E. S. Newcomb, J. H. Allison, R. W. Newcomb.

Ex-Cell-O Tool and Manufacturing Co., Detroit; N. A. Woodworth, Clifford Peacock, Philip A. Huber, C. R. Alden, W. F. Wise, E. H. Hopson.

Firth Sterling Steel Co., McKeesport, Pa.; C. O. Ericke, C. E. Hughes, E. T. Jackman, Alan Jackman, D. E. Jackman, Jr., G. A. Jacobs, T. A. Larecy, W. A. Nungester, I. Olsen, W. C. Royce, M. E. Burkemer, Al. Mattson, H. I. Moore, W. A. Ruppel, A. C. Letts, D. G. Clark, Frank Marth.

J. B. Ford Co., Wyandotte, Mich.; F. R. Merrick, B. N. Goodell, T. S. Blair, L. C. Warden, C. R. Beaubien.

William Ganschow Co., Chicago; C. H. Thomas.

Gardner Tap and Die Co., Cleveland; J. M. Gardner, C. M. Jackson, H. P. Boggis, Fred E. Criley.

General Alloys Co., Boston; H. H. Harris, E. P. VanStone, W. K. Leach, A. L. Grinnell, J. J. Donovan, R. M. Kirk, H. G. Chase, A. D. Heath.

General Electric Co., Schenectady, N. Y.; D. G. Brokaw, R. F. Newell, L. B. Rosseau, Walter Anderson, L. A. MacKenney, H. E. Scarborough, C. H. Lockwood, C. L. Ipsen, A. N. Otis, C. T. McLoughlin.

Geometric Tool Co., New Haven, Conn.; E. W. Mertz, E. J. Gillis, F. W. Gowrie, F. A. Barker, E. L. Wood, G. A. Denison.

Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.; Messrs. Kraut, Gebuhr.

Gisholt Machine Co., Madison, Wis.; E. S. Chapman, C. B. Carr.

Goddard & Goddard Co., Detroit; A. N. Goddard, C. H. Wallace, R. T. Rice, E. E. Toerner, E. E. Guntert, C. S. Goddard.

Goss & DeLeeuw Machine Co., New Britain, Conn.; S. T. Goss, J. J. Spring, E. H. Peck.

Gould & Eberhardt, Inc., Newark, N. J.; Fred Eberhardt, H. W. Jacobson, G. H. Davis.

G. A. Gray Co., Cincinnati; August Marx, F. E. Cardullo, Tell Berna, Philip Leisinger.

George J. Hagan Co., Pittsburgh; R. E. Talley, H. G. Hammer, J. Sandberg, V. A. Hain, C. F. Cone, J. L. Edwards, A. D. Dauch.

Halcomb Steel Co., Syracuse, N. Y.; H. J. Stagg, M. P. Spencer, J. H. Hinkley, J. F. Kirwan, Arthur Schroeder, T. F. Wood, F. W. Ross, S. C. Spalding, J. T. Leyden, J. H. Schnibbe, E. F. Talmage.

Hammond Manufacturing Co., Cleveland; C. M. Allen, W. D. Buss.

Hanson-Whitney Machine Co., Hartford, Conn.; E. A. Hanson, C. A. Lauridsen, J. W. Johnson.

Heald Machine Co., Worcester, Mass.; J. N. Heald, S. T. Massey, R. M. Lippard, R. A. St. John, F. H. Grimshaw.

Heim Grinder Co., Danbury, Conn.; F. M. Angevin, C. Booth, R. Krametz, C. Previdi.

Heppenstall Forge & Knife Co., Pittsburgh; G. I. Allen, F. C. Moyer, G. O. Desautels, C. W. Heppenstall, E. O. Jenkins.

Hevi-Duty Electric Co., Milwaukee; E. A. Hansen, Edward Busch, F. A. Weiser.

Holcroft & Co., Detroit; C. T. Holcroft, H. L. Ritts, Alfred Ruckstahl.

Hoskins Manufacturing Co., Detroit; W. D. Little, C. S. Kinnison, W. A. Gatward, J. D. Sterling.

E. F. Houghton & Co., Philadelphia, Pa.; H. G. Lloyd, H. E. Cressman, W. J. Wright, Robert Smith, W. A. Buechner, J. C. Bentley, F. L. MacNamara, W. A. Fletcher, I. D. Fletcher, D. D. Reed, E. C. Redlin.

International Machine Tool Co., Indianapolis; D. J. Cosner.

International Nickel Co., New York City; A. J. Wadhams, Dr. P. D. Merica, Charles McKnight, Jr., T. H. Wickenden, J. S. Vanick, L. Muller Thyn, R. A. Wheeler.

Interstate Iron & Steel Co., Chicago; Paul Llewellyn, W. H. C. Carhart, Elmer Larned, John A. Guyer, R. S. LeBarre, W. J. MacKenzie.

Jessop Steel Co., Washington, Pa.; V. M. Wellman, R. K. Greaves, V. H. Lawrence, J. M. Curley, C. R. Trimmer, E. V. Vogeley, W. J. Fredericks.

Jones & Lamson Machine Co., Springfield, Vt.; H. S. Beal, C. H. Seaver, F. L. Watkins, J. L. Reilly.

Jones & Laughlin Steel Corporation, Pittsburgh; A. A. Wagner, E. A. France, J. G. Hutchinson, S. A. Fuller.

Kearney & Trecker Corporation, Milwaukee; Theodore Trecker, E. J. Kearney, J. B. Armitage, Joseph Trecker, W. K. Andrew, G. L. Erwin, Jr., R. A. Wellington, Clarence Hochmuth.

Keller Mechanical Engineering Corporation, Brooklyn, N. Y.; Jules Dierckx, A. J. Benson, P. Brown, Charles Bitter.

Kelly Reamer Co., Cleveland; E. W. Putman, M. C. Daw, A. H. Howard.

Keystone Lubricating Co., Philadelphia; Peter Cassady, V. Berguson, M. C. Schwenk, F. D. Street.

King Machine Co., Cincinnati; E. A. Muller.

W. B. Knight Machinery Co., St. Louis; W. B. Knight, Jr.

Landis Tool Co., Waynesboro, Pa.; J. S. Baker, I. S. Deardorff, F. Griner, C. M. Talhelm, W. G. Nevin.

Leeds & Northrup Co., Philadelphia; G. W. Tall, Jr., A. E. Tarr, Henry Brewer, E. B. Estabrook, O. Brewer, P. H. Taylor, A. F. Morany, H. R. Abey, C. C. Graf, W. A. Lane, T. C. Smith, Jordan Korp, J. P. Docherty.

Lehmann Machine Co., St. Louis; Paul Lehmann.

E. Leitz, Inc., New York City; Messrs. Ziegler, Vollrath.

Leland-Gifford Co., Worcester, Mass.; S. Nikoloff, S. B. Dowd, A. H. Anderson, E. A. Heidlinger.

Liberty Machine Tool Co., Hamilton, Ohio; A. R. McCann, A. Lutzig, J. Milliken.

Lodge & Shipley Machine Tool Co., Cincinnati; Fred Albrecht, J. M. Stephens.

Lucas Machine Tool Co., Cleveland; F. P. Sprague, J. A. Leighton.

Lud'um Steel Co., Watervliet, N. Y.; H. G. Batcheller, W. H. Vrooman, C. B. Templeton, A. K. Martin, R. P. DeVries, W. H. Keen, W. J. Fitzgerald, W. L. Weaver, T. C. Sherman, P. R. Thurston, W. Kinsey, J. E. Polhemus, H. W. Spiegel, H. I. Askew, Jr., J. J. Cruice.

Marschke Manufacturing Co., Indianapolis; W. A. Marschke.

Midvale Co., Nicetown, Philadelphia, Pa.; Stuart Hazlewood, H. H. Ziesing, H. E. Rowe, W. A. Miller, F. W. Sager, Harry Teel, T. G. Besom.

Monarch Machine Tool Co., Sidney, Ohio; W. E. Whipp, J. A. Raterman.

Morris Machine Tool Co., Cincinnati; E. G. Meckstroth, A. C. Pletz.

Morse Twist Drill & Machine Co., New Bedford, Mass.; W. T. Read, F. O. Lincoln, W. F. Congdon, M. G. Bonner, R. W. Mein.

Motch & Merryweather Machinery Co., Cleveland; G. E. Merryweather, E. R. Motch, E. R. Motch, Jr., R. J. Houck, J. S. Phelps, W. F. Wissman, W. F. Hall, A. B. Einig, W. F. Gallen, R. G. Knapp, E. A. Shriver, M. H. Jones, L. C. Lobitz, E. C. Batchelar, J. T. McCuen, L. A. Rafferty, J. A. Menges, L. C. Deckard, J. L. Vance, R. C. Handloser, E. F. Lickey, E. A. Guntrum, H. A. Bayliss, J. F. Dittus, V. Gottsman, N. H. Carpenter.

National Automatic Tool Co., Richmond, Ind.; F. A. Root.

National Equipment Co., Springfield, Mass.; A. L. Bausman, G. A. Bausman, Joel Whitney, Charles Gowing, John Peterson.

National Twist Drill and Tool Co., Detroit; Harry Butler, C. Cornwall, G. Webster.

New Britain Machine Co., New Britain, Conn.; H. H. Pease, E. L. Steinle, G. K. Atkinson, T. C. Stirling, H. L. Wilson, C. L. Perry, C. Hanson, S. Mayerjack.

Norton Co., Worcester, Mass.; O. E. Nordstrom, Erick Hellstrom, O. A. Knight, C. H. Hill, W. T. Montague, H. J. Griffing, H. W. Dunbar.

R. D. Nuttall Co., Pittsburgh; Q. W. Hershey, J. E. Mullen, W. H. Phillips, R. W. Young, W. H. Smith, C. H. Parker.

Oesterlein Machine Co., Cincinnati; G. M. Meyncke.

Ohio Steel Foundry Co., Springfield, Ohio; T. H. Harvey, C. E. Malley.

The Oilgear Co., Milwaukee; Donald Clute, Harold Crull.

O. K. Tool Co., Shelton, Conn.; F. J. Wilson, R. R. Weddell, R. S. Young, Frederick Schroeder.

Oliver Instrument Co., Adrian, Mich.; E. C. Oliver.

Tinius Olsen Testing Machine Co., Philadelphia; Jacob Lundgren, W. J. Tretch.

Oxweld Acetylene Co., New York City; E. E. Thum, J. W. Dunn, J. P. Dawson, J. V. Upton, H. H. Dyar.

Park Chemical Co., Detroit; J. N. Bourg, D. W. Bauer, F. W. Faery.

Peerless Machine Co., Racine, Wis.; R. T. Ingalls, A. H. Goetz, Charles Rasmussen.

Henry Pels & Co., New York City; T. C. Sternblad.

Pittsburgh Crucible Steel Co., Pittsburgh; F. B. Hufnagel, R. M. Keeney, A. H. Sonnhalter, O. L. Pringle, S. D. Williams, W. I. McInerney, E. T. Walton, W. E. Davis, W. P. Benter, W. R. Howell, W. W. Williams, K. E. Porter, J. N. Critchlow, T. A. Goodridge, H. T. Harrison, B. B. Holt, Myron Powers.

Pittsburgh Instrument & Machine Co., Pittsburgh; Paul Kammerer, Charles Trueg.

Potter & Johnston Machine Co., Pawtucket, R. I.; N. R. Earle.

Pratt & Whitney Co., Hartford, Conn.; W. P. Kirk, A. E. R. Turner, J. J. Heber, G. E. Thomas, E. C. Shultz, E. J. Sullivan, A. H. d'Arcambal.

Production Machine Co., Greenfield, Mass.; A. H. Behnke, Mr. Fuller.

Republic Flow Meters Co., Chicago; J. S. Cunningham, C. C. McDermott, G. V. Nightingale, M. E. Van Vliet, A. M. Steever, F. A. Hall, D. J. Jones.

W. S. Rockwell Co., New York City; J. N. Voltman, C. D. Barnhart.

Rockford Machine Tool Co., Rockford, Ill.; M. Monson, W. K. Stamets.

Rockford Milling Machine Co., Rockford, Ill.; C. B. DeVlieg, G. A. Markuson.

Rodman Chemical Co., Verona, Pa.; Hugh Rodman, G. A. Webb, S. P. Rockwell, W. D. Fuller, O. T. Muehlemeyer.

Roessler & Hasslacher Chemical Co., New York City; W. M. Gager, C. H. Proctor.

Sebastian Lathe Co., Cincinnati; E. E. Stokes.

Seneca Falls Machine Co., Seneca Falls, N. Y.; E. R. Smith, J. A. Fyfe, W. H. Nettle, F. B. Webb, M. C. Day, G. J. Hawkey.

Shore Instrument and Manufacturing Co., New York City; F. G. Kendall.

Simonds Saw and Steel Co., Fitchburg, Mass.; G. T. Curtis, H. B. McDonald, H. D. Weed.

The Skinner Chuck Co., New Britain, Conn.; Wm. H. Day.

Skybryte Co., Cleveland; T. T. Holt, V. S. Loventhal.

Spencer Turbine Co., Hartford, Conn.; S. E. Philips, H. M. Grossman.

William K. Stamets Co., Pittsburgh; W. R. King, W. H. Barber, G. D. Miller, W. E. Tabb, W. K. Stamets.

Standard Tool Co., Cleveland; H. C. McKean, R. T. Lane, E. E. Northway, H. Will, Clarence Buck, T. Bascom, D. R. Higgins, D. G. MacMillan, J. G. Green.

L. S. Starrett Co., Athol, Mass.; D. Findlay, A. H. Starrett, O. J. Rogers, J. E. Hindes.

Strong, Carlisle & Hammond Co., Cleveland; T. W. Carlisle, G. E. Kruger, W. H. McClelland.

Strong, Carlisle & Hammond Co., Furnace Department, Cleveland; G. S. Peterson, J. Weintz, A. B. Lindsay, T. W. Clark, F. C. Parsons.

Sun Oil Co., Philadelphia; R. S. Drysdale, C. K. Hague, C. B. Harding.

Surface Combustion Co., New York City; F. W. Manker, F. J. Winder, C. A. Blesh, A. A. Treadway.

Swedish Crucible Steel Co., Detroit; Henry Nixon, S. R. Allen.

Wm. Swindell & Bros., Pittsburgh; E. H. Swindell, R. W. Porter, F. W. Brooks, G. P. Mills.

Taylor & Fenn Co., Hartford, Conn.; G. S. Delany, Niels Carlson.

Taylor Instrument Companies, Rochester, N. Y.; G. A. Howell, H. W. Maurer, Jr., A. H. Goddard.

Thompson Grinder Co., Springfield, Ohio; H. J. Warrick.

Henry G. Thompson & Sons Co., Hartford, Conn.; Fellows Thompson, Graham Thompson, T. A. Hyde.

Timken Roller Bearing Co., Canton, Ohio; M. T. Lothrop, A. J. Sanford, C. A. Swan, T. W. Hardy, H. W. McQuaid.

Union Twist Drill Co., Athol, Mass.; J. H. Horrigan, G. F. Holland, L. H. Laythe, G. E. Stople, G. G. Hunter.

United Alloy Steel Corporation, Canton, Ohio; H. H. Pleasance, M. H. Schmid, F. W. Krebs, R. B. Kelley, J. D. Jones, M. A. Grossman, N. L. Deuble, C. C. Snyder, B. H. Shirk.

Universal Grinding Machine Co., Fitchburg, Mass.; R. D. Gould, G. S. Gould.

Vanadium-Alloys Steel Co., Latrobe, Pa.; R. C. McKenna, W. S. Jones, L. D. Moberg, J. P. Gill, L. D. Bowman, J. H. Roberts, W. R. Mau, A. F. McFarland, J. H. Caler, R. R. Artz, T. J. VandeMotter, G. E. Reminger.

V & O Press Co., Hudson, N. Y.; H. U. Herrick, F. A. Bearsley.

Walcott Lathe Co., Jackson, Mich.; D. G. Kimball, N. R. Townley, C. H. Sylvester, R. G. Williams.

O. S. Walker Co., Worcester, Mass., C. O. Smith.

The Warner & Swasey Co., Cleveland; C. J. Stilwell, K. L. Pohlman, James Craig, A. C. Cook, W. K. Bailey.

Westinghouse Electric & Manufacturing Co., Pittsburgh; W. S. Scott, R. T. Ruttencutter, M. R. Armstrong, F. G. Allen, W. H. Sugg, J. F. Sweney, Jr.

Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.; A. O. Fulton, F. H. Lovejoy, E. E. Bartlett, G. A. Barch, C. H. Williams, F. F. Blosser, E. P. Gaffney, T. W. Knight, L. P. Needham, F. J. Devan, A. R. Townsend.

The Whitney Manufacturing Co., Hartford, Conn.; D. I. Wheeler, C. E. Wertman, S. C. Smith.

Wilmarth & Morman Co., Grand Rapids, Mich.; C. H. Slaughter, A. Williams.

Wilson-Maeulen Co., New York City; J. P. Roberts, C. E. Hellenberg, Harvey Lee.

Impetus Given Production Activities of S.A.E. at Cleveland Meeting

Quality of papers high and discussion enthusiastic—Attendance good—Co-operation with A. S. S. T. successful—Abstracts of papers

THE Society of Automotive Engineers is gratified by the success of the production meeting held in Cleveland Sept. 14-16 in conjunction with the annual convention and exposition of the American Society for Steel Treating.

Indications are that there will be another S. A. E. production meeting next year in Chicago during the A. S. S. T. eighth annual convention.

More than three hundred attended the S. A. E. sessions, a high attendance when that number is compared to the total production membership of the society.

Because of the success of this year's meeting and because of the quality of the meeting, it is probable that the society will in the future be inclined to give more consideration to its production members than it has in the past. The added attention would be shown by a greater number of production meetings and by a continuance of a careful selection of subjects for papers.

Closer Co-operation

A point of importance of the Cleveland meeting was the indication of closer co-operation from now on between automotive manufacturer and machine tool builder. It seems that each wants from the other something he does not get, in service, price, machine life, material, specifications, standardization, or some other division or phase involved in their dealings. Builder and user talked together frankly and may be on the verge of understanding each other's troubles, shortcomings and requirements. Many of the points of difference, misunderstanding and sometimes contention between the two industries are brought out in the Cleveland papers and abstracts of papers in the *American Machinist*.

About 400 attended the production dinner on Tuesday evening and listened to President Harry L. Horning's welcoming words, and acknowledgement to the Steel Treaters. W. H. Eisenman, secretary of the American Society for Steel Treating, suitably replied.

The principal speaker of the evening was K. T. Keller, vice-president and general manager of the General Motors Corporation of Canada. He spoke on production matters directly to the production men.

Quality first, then quantity, then cost, are the three main factors entering into a modern product, he said. Quality is largely a matter of discipline as well as organization, and the workman should be given the opportunity to make the car right at first. For this reason it is poor policy to have inspectors stand over a man to see if he performs his task properly. If the inspector in such a position can do it better, he should be the one to do it.

This statement does not mean that inspection should be abolished. Mr. Keller stated that in his plant he had picked out his best mechanic, and made him chief inspector, and had him report directly to the general manager.

Less Experimentation

In commenting on the problems of quantity he said that product should be built only when wanted and that the amount wanted should be most carefully planned for. At first quantity production is entered into rather confidently with several tentative experimental schedules which it is hoped are safe. As experience in planning schedules grows there will be fewer experimental parts, and more of the whole based on cold facts. The assembly line is the controlling factor and great care should be taken to see that its work is planned for efficiently. "The man who controls the assembly line controls production."

Inventory was another factor discussed by Mr. Keller. In his own plant he has reduced and controlled his inventory to a point where a 14 days' bank of material suffices.

The great bugbear of cost is overhead. Every man who is not directly engaged in the actual work of fabrication should have his activities and value analyzed at least once each year to answer the questions: "Is he necessary?" "Can he be replaced with another and better man?" "Can his work be added to or substracted from?" Men should be intelligently placed on work they are best fitted for. Another point stated was that men should not be taken in a gang from one plant to another along with a change of executives. The new executive should find and encourage men already on the job. Money should not be spent too easily on hiring and firing men. Rather should they be given a chance and kept moving up in the line of production.

Future Executives

Mr. Keller concluded by stating that he selected six young men each year and virtually trained them as apprentices in his plant. Some develop toward the selling or service end, others toward the factory or engineering departments. At all times these youths are under the direct personal scrutiny of the general manager who is interested in the training of future executives.

The list of papers presented during the three-day meeting follows:

"Hot Stampings," by G. F. Keyes of the Mullins Cody Corporation.

"Sheet Steel Fabrication," by Syd Smith of the Studebaker Corporation of America.

"Training of Employees in Production Work," by William M. Gilbreth of the Gilbreth Inc.

"Products and By-Products of Foremen's Conferences," by F. T. Jones of the White Motor Co.

"The Training of Shop Foremen," by Louis Ruthenburg, the Yellow Sleeve Valve Engine Works, Inc.

"Co-ordinating Designs and Production Methods in Gear Development," by P. L. Tenney of the Muncie Products Division, General Motors Corporation.

"The Problem of Gear Production," by Earle Buckingham of the Niles-Bement-Pond Co.

"Machine Tool Needs of the Automotive Industry," by R. M. Heidey of the White Motor Co.

"Machine Tool Selection," by W. G. Careins of the Ajax Motors Co.

"Drill Press Applications," by R. M. Anderson of the Holley Carburetor Co.

"Analysis of Machine Tool Mainte-

nance," by A. R. Kelso of the Continental Motors Corporation.

"Jigs and Fixtures in Automotive Production," by J. Gustav Moohl of the Cleveland Automobile Co.

"Making Machine Tools Safe," by R. F. Thalner of the Buick Motor Co.

"Inspection Methods," by C. J. Ross of the Buick Motor Co., Flint, Mich.

"Some Aspects of Inspection in the Airplane Industry," by J. J. Feeley of the Glenn L. Martin Co.

Abstracts of many of the papers follow. A number of the other papers will be printed in full in the next issue of the *American Machinist*.

Some Aspects of Inspection in the Airplane Industry

By J. J. Feeley
Glenn L. Martin Co.

IT IS not my intention to give you the impression that airplanes are difficult to build, for such is not the case. They do not require a finer precision than is required in the automobile industry. There is, however, a multiplicity of detail involved and no detail is so insignificant that it escapes attention. Strength and safety are two of the primary considerations.

An airplane is a very highly stressed mechanism and if the design is to be successfully and safely carried out, some organization must be charged with the responsibility of meeting the engineers' intentions, and co-ordinating their efforts with those of the manufacturing or repair organization.

The very nature of building airplanes calls for a capable personnel, careful of the safety of the structure on which it is working. In any airplane building organization all errors in practice or drawings should have the inspector's immediate attention and if he feels that he has not the necessary data (and he must know fully what the data should be) he should consult with the engineers who have it.

I am not a believer in inspection for inspection sake, and no inspection is worth the name or money spent on it that cannot do constructive work and know at all times that the intentions of the designers are being carried out in detail, and consequently the safety of the craft secured. There is no halfway mark, and an inspector should be in a position to be fearless in his criticism.

Inspection Profitable

Inspection can be the greatest force for good and constructive work if organized properly and handled accordingly. The inspector is constantly in touch with the manufacturing organization and very often is in a position to offer valuable suggestions to the designer in accomplishing shorter methods and better practice.

Each part of an airplane is designed to weigh so much, with an allowance of three or four per cent either way. The inspector weighs and records the weight of each item after its part number. A copy is forwarded to the engineers who adjust these weights to suit the various assemblies. If the overweights accumulate too fast a redesign may be necessary.

The Army and Navy have done a great deal of very important inspection research and maintain an office in the factory where contract work is being done. Practically all contact between the manufacturing organization and the Army and Navy representatives is through the inspection force.

All ferrous and non-ferrous material as it is received is held in bond. A sample for chemical and physical test is taken from numerous pieces and forwarded to the testing laboratory where its physical and chemical properties are determined.

A report of these properties is forwarded to the inspector for comparison with specifications and determination of suitability for the purpose intended, and released for production or rejected. During the time the specimens are in the laboratory, each piece of material is given a thorough surface inspection to locate defects such as cracks, seams, laminations.

Marked by Painting

Very often material which meets the chemical and physical tests is rejected for surface defects. The gage and diameter are very carefully checked to determine the proper cross-section. After all metals are released by the inspector, each piece is painted with its conspicuous color to identify it.

All copper and other tubing used for air, gasoline, oil and water lines, is submerged in water and tested with air at 15 lb. pressure. All defects are immediately cut from the piece and only good material stocked. All valves and shut-off cocks are tested with a head of gasoline equivalent to 15 lb. pressure and must show no leaks.

Gasoline is received in large quantities and before it is discharged to our storage tank, a sample is taken from the bottom of each compartment and forwarded to the laboratory where its initial- and end-point specific gravity and residue are determined.

Hundreds of other items of material are used and each one receives the same minute inspection and control to assure compliance with specifications and drawings.

Recent designs of aircraft provide for extensive use of aluminum and aluminum alloy. Aluminum has no value as a structural material and is used only in places where there are no severe stresses, such as engine cowls, seats, doors, etc. The aluminum alloy containing copper and small percentages of other alloying metals has decided structural value. It is almost as strong as low-carbon steel in tension, has a modulus of elasticity about one-third that of steel, and weighs about one-third as much. It works more easily and can be fabricated as readily.

The distinguishing and noteworthy characteristic is the spontaneous aging effect after heat treatment. This treatment consists of heating the metal to 900 deg. F. and quenching in boiling water. If further work is to be done before aging is completed, it should be done as soon as possible after the material has reached the temperature of boiling water. The essential feature of this heat-treatment is accurate and uniform temperature control.

The control is obtained by the use of a mixture of half and half molten sodium nitrate and potassium nitrate in a steel tank heater by an electric or fuel fire. Each step in these operations is periodically checked by the inspector. Very injurious defects can come from overheating and improper cooling.

For the amateur aircraft builder to go into the open market and buy steel for his various structural purposes without specifications, and proof of compliance, is a decided risk, sometimes fatal, as many cheap grades of materials, perfectly harmless looking, are loaded with possible failures. Very often steel not properly cold-worked, very low in carbon, or in the annealed condition, does not give the physical properties desired. Material of this sort is often high in sulphur and phosphorous. Sulphur is classed as an injurious element in steel being conducive to increased corrosion and segregations which render it unreliable. Phosphorous is a decided impurity as it reduces the ductility. All material used should give evidence of failure before actual failure takes place.

The machinery used in the fabrication of metal parts is of the conventional type and very little special machinery is used. All operations, however, are carried on with the greatest care and precision to insure the final result. Numerous jigs and fixtures of special design are used to facilitate production and the first piece of each operation is brought to the inspector for check before proceeding with the whole number.

Checked After Fabrication

As the parts and detail assemblies are completed, they are forwarded to the metal parts inspection department where they are closely examined for cracks which sometimes develop during fabrication. When this condition exists, it is cause for general check upon the methods and materials, to eliminate the possibility of defective assemblies. Each assembly is checked for dimensions against its detail drawing.

All holes must have a uniform amount of material around them to develop the full strength of the respective part. All threaded parts must fit without appreciable shake to eliminate the possibility of vibration wearing the threads and becoming liable to failure. All threads must be full threads according to U. S. Standard. Holes drilled in tubes are always on the neutral axis of the tube to eliminate any unequal leading condition.

All struts must be straight for the same reason. All heat-treated parts

are checked carefully in the conventional manner to determnie the proper condition of the metal. Some assemblies have pieces of the original material attached to them which are removed after heat-treating and sent to the laboratory for physical test. This material is not released until the results of the tests are known and if successful, are released for further operations or stock.

All gasoline, oil, and water tanks are frequently of welded aluminum construction. After completion of this work, each is pressure tested with air and each welded joint is sounded with a light steel hammer to be sure of a good bond. Each assembly is stamped with the individual inspector's stamp.

The matter of corrosion prevention is of a great consequence and all tubes and tubular assemblies are dipped in hot mineral oil which will not become rancid with age, or they are sand blasted and varnished with standard varnish containing aluminum pigment. All other parts and assemblies are zinc plated, which is the best known method for corrosion prevention and protects the steel by destroying itself.

The art of brazing is carefully handled. All parts to be brazed must fit with minimum clearance, be well cleaned and assembled carefully. The brass is composed of 50 per cent copper and 50 per cent zinc and melted in a crucible. When this alloy reaches the required temperature, the parts to be brazed are covered with flux and carefully immersed and held in the brass until all joints are well heated through. Any assembly which has a well-brazed joint of proper area will not fail where brazed.

Welding is carefully done with a neutral oxy-acetylene flame, and is carefully checked to eliminate cold welds and burnt material. Some very clever welding is done on many difficult assemblies. Large assemblies of welded construction are held within a tolerance of $\frac{1}{32}$ in. This is remarkable when the element of shrinkage and warping is considered. All operations are constantly watched by qualified inspectors.

Training Employees in Production Work

By Lillian M. Gilbreth
Gilbreth, Incorporated

PRODUCTION is the most important phase of industry and therefore the training of employees in production work is of paramount importance. The aim of this paper is to evaluate training in terms of production.

Such training should have three distinct aims: first, to make a better worker in the particular job, second, to make a better member of industry and third, to make a better member of the community. However, the activities of such training must finally submit themselves to evaluation in dollars and cents. Only when it meets these demands can science demonstrate its human as well as material value to the world.

Successful production demands from the worker the greatest output with the least amount of effort. The worker must be trained to do the highest type of work of which he is capable. His surroundings and equipment must be of the best. These are the factors with which employee training concerns itself.

The topics with which we must deal are what should be taught, who is to teach it, when is it to be taught, where is it to be taught, how is it to be taught and why is it to be so taught.

In presenting what is to be taught, one must understand what industry is as a whole, what the work being done in the plant stands for, the work of the department, the operations performed in it, the processes under each operation, and finally the elements of motion cycles and fatigue study. In order to increase production one must eliminate motions and fatigue, simplify existing methods and standardize the findings of these studies for wider application. There should, finally, be records of the one best way of doing each job.

The next question concerns who is to do the teaching. This may be done by an efficient worker from whom the others can learn. The worker, however, usually lacks skill or sympathy in teaching. The foreman can do it but he must be in sympathy with the problems of the worker and have a real liking for teaching. He is a key man in industry and should live up to what is expected of him. If the training department undertakes the work itself it should furnish not only preliminary training, but also training at the work place itself. Supplementary courses are a valuable feature in training.

The work of training, if the courses cover an extended range of time or change in method, can best take place away from the distraction of working conditions. To be completely taught, the worker must be able to do a correct job continuously, and must want to do it, before he has actually learned how in the right sense of the term. In this connection, the follow-up phase of teaching plays a very important part.

In the laboratory or class room the instructor can control variables and make accurate records, but the actual variables of the work in the work place are lacking, as well as the incentive. The teacher can only get information by actually doing the work himself, in the work place, and with the working incentives, that is, as a working member of the working force.

Teachers should undergo some training themselves in order to properly accomplish their aims. They should periodically return to the shop and work there under the conditions in which the working men find themselves. It should be the duty of the teacher to note the improvements in the various factors of the work, and to see that the method is improved to meet the changing conditions and to see that it is taught and maintained in its most recent form.

Teaching should be done first through the eye by means of text books and graphs and second through the ears by means of lectures. Demonstrations should never be neglected.

If every operation in industry could be studied with the idea of relieving the eyes, if training could be done blindfold until all those parts of the operation, which could be done without the eyes, were done efficiently, if the eyes were spared for everything but inspection, an enormous saving would result.

A general survey of the availability of the different senses for inspection should be made so that touch, taste and smell as well as sight can be used wherever possible.

Education, in its best sense, consists of two things, research and transfer. Education in industry, in any scientific way, is a new thing, and the problems are more complicated than in the schools and colleges. The teacher must consider the variety of the work to be learned and the ability of the learner. There are those in industry who have learned much and those who have learned little, those who can learn easily and those who have stopped learning. The fundamental laws of the learning process must be applied to each individual need.

The result of the teaching along these lines is a definite increase in industrial efficiency. Illustrations of the applications of the methods outlined in various industrial fields, especially in the automotive industry, prove that output can be increased many times through efficient teaching.

Hot Stampings

By G. E. Keyes
Mullins Body Corporation

THE art of knowing how and doing it consistently is, in a large measure, responsible for the quality of hot stampings. Quality in hot-metal stampings such as fenders, dust aprons, radiator splashers and bodies for high-grade automobiles is the result of many years of experience in producing metal stampings of the most intricate design and character.

Among advantages of the hot-stamping method is the faithful accuracy with which the parts are produced and the infinitely lower cost of die making. These are particularly interesting from a mechanical standpoint.

Either wax, wood or plaster-of-paris models can be used. For example, if the designer prefers to make an outline drawing of a fender or body panel and work out details in the model, wax is the best material to use for this purpose as it lends itself to changes that can be made with little effort. Plaster

is used when a reproduction of a hand-built body or fender is desired. A plaster cast can be taken from the sample panels and a recast made. When complete body drafts are available and the design is predetermined, wood models are preferred.

The next step is to take off plaster casts from the models. The casts are built into patterns representing finished dies. From the patterns, the semi-steel dies are cast. This requires a special set-up in the foundry so the dies come out true to pattern.

The operator proceeds to build up the face of the female die with alternate layers of lead, hardened with antimony. The successful operation of the die depends on the manner in which the lead "pick-ups" have been poured. After all the "pick-ups" have been made, the die is set in the press to have the male portion of the die cast. As soon as the male die is cold, it is attached to the ram of the press and raised clear of the die. A heavy-gage plate is placed on top of the "pick-ups" and the top die dropped if a drop-hammer is used, or squeezed if a single-action press is used. The operation forms the heavy plate that is attached to the upper die. Stampings are then run through the press and partially formed.

A new upper die is made to conform to the exact shape of the semi-steel die. After the new die has been made and lined, or covered with steel and asbestos, the hot run is made, stampings are heated to a cherry red and run through the dies. After the stampings have been run hot and cooled, they are re-run through the die with irons added to the die to sharpen corners and to set beads, also to take out shrinkage caused by the cooling of the stamping.

This process is more complicated than cold-drawing stamping and it does not fit in with large production. When small production is desired or when it is necessary to get into production in a short length of time, the hot-stamping process is the one to be considered.

Production requirements determine the advisability of making stampings hot or cold. There is a definite point in production where hot stampings are cheaper than cold ones, considering the comparatively small cost of hot-stamping dies against the expense of double-action dies.

From a standpoint of quality, the hot stamping is by far the better product. Hot stampings follow every contour of the die and retain their shape perfectly. There is no tendency to "spring" away from the form as there is in cold-drawn work.

Selection of Machine Tools

By W. G. Careins
Ajax Motors Co.

THE uses to which machine tools are put in various plants may be roughly divided into three classes, each of which places somewhat different demands on the equipment. The first of these uses is to be found in plants devoted to the manufacture of a variety of products in which there is very little duplication; in the maintenance and tool departments of production shops; and in the small job shop. This class of manufacturing requires tools of the widest possible range of usefulness, size and type. The factors governing the selection of equipment for this type of service are so extremely variable that their enumeration would be out of place in this paper, as each and every purchase requires special analysis.

Depends on Work

The second class of use would be found in shops devoted to fairly large production of a product which is subject to frequent changes of design, seasonable demand, or other conditions, which makes it impracticable to assume that manufacturing conditions will be settled for any long period. The average automobile shop of five to ten years ago is a good example of this type of manufacturing. The demands on machine tools in this class of service are not nearly so varied as in the previous class, although there must still be a certain amount of flexibility to the equipment. The machine equipment in this plant would consist very largely of standard machines equipped with special tooling, with an occasional single-purpose machine to take care of certain special or key operations.

The third class is to be found in plants engaged in large and intensive production of a standardized product subject to very little change in design from year to year, and in which quality standards and production methods to produce these standards have been thoroughly established. In plants devoted to this type of manufacturing will be found many machines of special design, often automatic or semi-automatic, capable of giving extremely large and continuous production. You will also find standard machine tools with all accessories and attachments removed which now are not necessary to satisfactorily perform the work for which they were purchased. You will find also that the machines in this class of service have been selected and arranged so that one operator can take care of two or more machines with the minimum of effort. In fact, in some cases the machines in a production line have almost lost their identity as individual machines and have become, through the use of conveyors and automatic handling devices, an integral part of a production unit which takes raw material at one end and turns out a finished article at the other end.

When new equipment is needed, it should be the first consideration of the person or persons responsible for its selection, to analize the situation and determine under which of three classes the requirements fall, taking into consideration the following factors:

1. Production—What is the production required? So far as possible the period that this production will be maintained should be estimated. Also consider the possibility of a gradual or rapid increase in demand. Remember that if a special machine is purchased, which has capacity to take care of your entire requirements, and this machine breaks down, your production stops.

2. Methods—Very careful consideration should be given to the method of machining to be used, the inspection tolerances, and the quality of finish required. If the equipment is for expansion or replacement and it is deemed advisable to change your methods, care should be taken to determine the effect of this change on previous or following operations.

Design May Change

3. Design—Investigate the possibility of a change in design which would make obsolete special machines, or expensive tooling. Some parts such as manifolds and brake rigging are particularly subject to frequent changes of design.

4. Production Cost—Special machines are usually selected with the idea of reducing costs. Production costs are calculated from direct labor, depreciation, interest on investment, maintenance, floor space and other items of this nature. However, in estimating the cost of producing a part on a special machine the depreciation factor should be approximately twice as great as the factor used for standard machines, due to the fact that the machines are likely to become obsolete due to change of design, before they are worn out. A higher maintenance cost should also be figured due to the difficulty and expense of obtaining repairs, and also there may be defects in design which will make excessive repairs necessary.

Standard Machines

5. Delivery—If equipment is needed at once the possibility of purchasing special equipment is immediately eliminated, since it is very seldom that such a machine can be designed, built, delivered and put into successful operation in your plant in less than three months, and often a much longer time is required. A method of overcoming this difficulty is to purchase standard machines, which can be readily converted to other work at a later date when the special machines are purchased.

6. Budget—The amount of money available for the purchase of new equipment often has considerable bearing on the selection, forcing the purchase of standard equipment even when the more expensive special equipment is desirable.

The information given to the machine tool builder should be as complete as possible, so that he can intelligently make his recommendations. In the case of special machines, provide him with a drawing showing a rough sketch of your ideas on the machine, indicating the points of location, the production per hour required, the method of handling the work in and out of the machine, the surfaces

to be machined, the work that has been performed in previous operations, hardness of the material, and any data that you may have available regarding feeds and speeds that have been used in the past on this operation. Give any other general information available, and if possible provide him with a sample of the work to be performed. In the case of standard machines very much the same procedure should be followed, except that it probably would not be necessary to make sketches.

In all cases the machine tool builder should be given as much latitude as possible in making his recommendations, as it is to the advantage of all concerned that the wide experience of the builder be utilized to the fullest extent. In fact the buyer is largely dependent on the manufacturer for information on new methods and processes which have been developed among users of machine tools.

Intelligent Recommendations

The next step is entirely in the hands of the builder. His job is to take the data furnished, thoroughly analyze them, request further information if any point is questionable, and from this analysis make his recommendations. A few companies upon the receipt of an inquiry containing the above data simply make out a formal quotation giving a general description of their machines, attach it to a circular and forward it to the buyer. If they give a production estimate at all, they probably state that a certain number of pieces per hour could be expected, giving no data as to how this estimate was arrived at, no data on feeds or speeds used, no information as to whether the figure given was 100 per cent time, or average floor to floor time. In fact, practically all of the information given is that they have a machine to offer at a certain price, and delivery is promised at a certain date. A proposal of this nature is very unsatisfactory, as it always leaves a doubt in the buyer's mind as to whether the builder has omitted furnishing this information through carelessness or if he has omitted it intentionally, knowing that complete data would not show up his equipment to the best advantage.

On the other hand, proposals will be received from other builders, put up in neat and attractive form, giving a complete analysis of how the work would be performed on their equipment, guaranteeing a definite production under certain standard conditions, specifying quality of work to be expected, and including a sketch showing tooling recommended. Perhaps to substantiate the claims time studies taken on similar or identical work performed on their type of equipment in other shops will be submitted. It is a simple matter for the buyer to take a quotation of this type, check the information given, and make a comparison of all quotations received.

In making a comparison, the first three items that would probably interest the buyer are production, cost of equipment, and the ability of the machine to give satisfactory service. Knowing these three things it is possible to approximate very closely the cost of producing work on any machine, as the direct labor cost can be calculated from the prevailing labor rates and number of pieces produced in any definite length of time, while the fixed overhead charges directly chargeable to the machine are largely determined from the estimated life of the machine, the repairs, and the original cost. Two of the above factors, namely production and cost are fairly definite, but the third factor, life and maintenance cost, must be determined largely from experience, and the policy of your particular company in regard to replacing equipment.

There are, of course, many other factors that should be considered before making a final decision. One of the most important of these perhaps is the reputation of the builder, not only as regards to workmanship, design and reliability of his equipment, but also the service and help that the user may expect from the builder after the machine is in operation in his plant. Does he maintain a complete stock of repair parts, or in case of a breakdown will the machine have to remain idle until the necessary parts can be made up either in your plant or in his? Does he furnish repair-part lists so that repairs can be intelligently ordered? And finally, does he try to help the user to get the maximum usefulness out of his equipment through the medium of service bulletins and expert demonstration?

Location of the plant manufacturing a machine also sometimes has some bearing on the final selection. If two machines are offered, one of which is built close to the buyer's plant, the other at a distance of several hundred miles, and if other factors are equal, certainly the machine built near by should be selected, because of the ease with which repairs and service help can be secured.

Another factor of considerable importance in your final selection is standardization of equipment. If several machines of a particular make are already in use in a shop, it is often desirable, from the standpoint of economy, to continue to buy that make and size of machine, as all attachments and fixtures can be interchanged from one machine to another. Also the stock of repairs carried in your own plant can be considerably reduced. In the case of milling machines, dividing heads, arbors, rotary tables, etc., can be shifted from one machine to another, and in the case of turret lathes and automatic screw machines, the same stock of cutter holders, roller turners, chucks and many other items of standard and special tools may be made to serve a large battery of machines.

Let us enumerate a few of the common weak points in design and workmanship that are likely to give trouble. In the first place there are a great many machines that are first-class in every respect except that the manufacturer insists on furnishing a countershaft that in no way measures up to the standard of the machine. Or if the machine is arranged for direct motor drive, the motor mounting is apparently an afterthought in the design. In the case of belt drive or belted-motor drive, the widths of drive pulleys have evidently been calculated for belts under ideal conditions, seldom met with in the average shop.

Another common cause of trouble on machine tools is the pump for cutting lubricant. There is nothing so exasperating in the machine shop as pumps that have to be primed every time the machine has stood for some time, or which do not have sufficient capacity at all speeds.

Cast-iron gears in the head or feed mechanism are almost always a source of trouble in machine tools, and the same is true of cast-iron cams and levers.

A great many manufacturers still design their machines with a large number of oil cups and oil holes, instead of lubricating all parts of the machine as far as possible from a central point. As many repairs are made necessary because of lack of lubrication as from wear and accident. It is possible to get the average mechanic to keep a central reservoir full of oil, but not many will properly lubricate a machine if they have to oil fifteen or twenty points once or twice a day.

Lack of accessibility for making repairs is another serious fault. Often it is necessary to almost completely disassemble a machine to make some minor repair or adjustment, and this is made still more difficult due to the fact that few manufacturers furnish instructions or blue prints showing the construction of their machines.

Foreman Training

By Louis Ruthenberg
Yellow Sleeve Valve Engine Works, Inc.

GOOD foremanship is a most important factor in establishing and maintaining high quality and low cost in production. The tool designer, the personnel organization, the inspection department and the engineering division all have tended to give the foreman a good set of "alibis" for the evasion of direct responsibility. It seems, therefore, to be a good idea to tell the foreman what all the shooting is about and to then hold him directly responsible for the operation of his department.

The foreman is not to be given priority over these functionalized departments but he should be trained in the ways of co-operation so that their function is not one of a club over the foreman. He must learn the arts of persuasion, sound salesmanship and diplomacy. He is the business manager of his department. He should have a working knowledge of simple economic principles and human reactions just as surely as he should have his practical trade knowledge. The possession of sound teaching ability is a most valuable asset to the foreman and to his organization.

It is a great tribute to human intelligence that foremen, today, function at

all effectively without systematic training or knowledge of industrial tradition and principle, of simple economic values, of the art of dealing with men in subordinate positions or in positions ranking with their own except as the knowledge is accidentally picked up.

Before the war the foreman was primarily a practical man who knew his trade above the average. We suddenly told him that we were going to teach him foremanship. Of course he laughed at the idea and the attempt was unsuccessful. Since the war there has been an effort to make the teaching of foremanship operate in a more successful manner.

In planning a foreman-training program, method is of greater importance than actual text matter. The foreman must be persuaded that there really is something still to be learned about the foremanship business and especially so since the rapidly changing conditions which we have been witnessing of recent years. Until an attitude of enthusiastic receptiveness exists or has been created among the men to be trained, attempts at training will produce disappointing results.

It must be remembered that results can be obtained only under able leadership and strong personal inspiration. A leading company official should take enough time to understand the matter, talk to the foreman about it and supervise the program. The lecturer must be a *teacher* and command the respect of the foreman for his knowledge and ability.

The initial text material can deal with the evolution of industry, starting with the story of individual craftsmen and their guilds, cottage industries, the change wrought by the great inventions of a century ago, tracing division and subdivision of labor, ever increasing specialization and then the modern system of functionalized control. From this beginning it is easy to move to the explanation of modern methods of processing, plant layout, machine-load analysis, stock control, planning, incentive methods in wage payment, time study, job analysis, efficient methods of selecting and teaching workmen, or any subject matter that may be a desirable part of the foreman's knowledge and mental equipment for his job.

It is difficult to train men in foremanship after they have attained the position at least in name. Training should start among candidates for the supervisory positions. Foreman apprenticeship and the "squad idea" are methods that are worth study on the part of our industrial organizations.

Products and By-Products of Foremen's Conferences

By Franklin T. Jones

Supervisor of Training, White Motor Co.

INFORMATION suitable for foreman training can be derived in condensed form from four sources: 1—*The Foreman*, training bulletin No. 26, U. S. Department of Labor, U. S. Training Service, 1919; 2—*The Industrial Supervisor*, Westinghouse Electric and Manufacturing Co., East Pittsburgh, Pa., 1923; 3—*Foreman Training*, Pittsburgh Personnel Association, June 1, 1924 and 4—*Foreman Training Methods*, American Management Association (National Personnel Association, 1922). This material will be found useful for reference purposes.

The state departments of vocational education are permitted under the Smith-Hughes and Vocational Rehabilitation Acts to provide facilities through the local Boards of Education for training teachers for those engaged in industry.

These powers have been directed toward the training of foremen on the ground that foremen were the teachers of the men in their departments. Therefore, under the law, it is possible to use public funds in foreman training. This training is usually given under the name of Foremen's Conference for reasons that are obvious to those who have had experience with foremen.

The majority of foremen have come up from the ranks of workmen. They have been selected because they have certain characteristics that make it possible for them to render great assistance in "getting out the work." The foreman is naturally suspicious when he is called into a production meeting and told about a new policy or given directions for changes within his department. He wonders what is being put over.

If his name is listed as one of those to take "foreman training" he will accept the appointment just as he would any other order given to him by a superior. He may not be at all convinced that the training will be useful to him or that it will really promote the interests of the company. Half of the time he will look on it as a means of "getting something on him."

In view of these facts, executives in industry have done wisely to call in the Smith-Hughes men and have the latter carry on training by the "conference method."

These leaders are usually men of industrial experience, in many cases ex-superintendents and foremen who have shown unusual skill in adapting themselves to groups of more or less hostile or apathetic foremen, and getting them to talk about their jobs, frequently on the ground that this is done in order to put across ideas with groups of workmen or other foremen.

It is better for the leader of such a group to be a person who has no authority over the individual members. It is, therefore, a mistake for the initial foreman training to be carried on by a leader who is a member of the organization.

The outsider must be a man of judgment who can lead the discussion wisely in directions profitable for the company. It is advisable that he spend a considerable period of time inside the factory, looking over departments, observing methods of manufacture, talking with executives and making himself virtually a member of the organization. In other words he must master the policies and principles of the organization as well as the product if he expects to obtain more than mediocre success with the group of foremen.

In establishing foremen's conferences the greatest care must be taken that the method used shall inspire confidence.

It is not at all infrequent to find management cautious, or even overcautious, in plans it makes for meetings of employees. Measures poorly conceived are most likely to produce dissatisfaction.

Selling the Organization

Wise management will see to it that the entire organization is sold on any measure before it is put in effect. A manufacturing committee will do well to call in the possible conference leader and have him explain the plans and programs that he expects to put in effect. In this manner, the committee has an opportunity to judge the wisdom of the leader and to decide whether its confidence in him will justify turning over to him one of the most important functions of the entire organization.

The leader has within his power to confer great benefit or to produce great damage. The conference leader should have a known record of performance. It is to his advantage if he has been a foreman and if he possesses the personal qualities of leadership.

There is a decided tendency in training in industry for the training to be sporadic. A man or group of men in management has advanced ideas and succeeds in putting them into effect. As a result, the organization embarks upon a program of training that may be pretentious. An enthusiastic supervisor of such work is likely to oversell its value and to expand its activities faster than the organization can benefit by them. The result is inevitably that men for advanced positions are developed faster than they can be placed.

Unrewarded ambition and merit make them dissatisfied employees. If they remain within the organization, they become trouble makers and reflect unfavorably on the morale of all with whom they come in contact.

Definite Advantages

Hence, we see training in industry proceeding in an organization as a succession of waves, each within its crest and trough, instead of a steady progress represented by an inclined plane. It is evident that foremen's conferences as a succession of groups, rather than as a simultaneous activity of all the foremen in the organization, have definite advantages. Likewise, over-expansion in training activities is as serious a business blunder as over-expansion in production or sales activities.

The time is bound to arrive when all

the foremen of an organization will have passed through the series of preliminary conferences.

As a result of an inquiry sent to department heads asking for their opinions of foremen's conferences, the following were submitted as examples of products (direct results):

Better understanding of responsibilities and duties, better slant on the other fellow's problems, larger and better acquaintanceship, better-co-operation, better tact and diplomacy, thinking about the foremen's job, philosophy of handling men, self-analysis, opportunity for self-expression, getting management's point of view, greater interest in the job and preparation for promotion.

Some of the by-products (in direct results) were:

Interest in company's problems, more progressive toward new methods, men get together to figure out problems, co-ordinating own work with others, broader vision on common problems, increased efficiency—more businesslike, proper man for a given job, rating and ranking of men, substitution of discussion for argument, conviction of foremen that management wants them to progress, willingness to receive training, and men better known by executives.

Making Machine Tools Safe

By R. F. Thalner
Safety Director, Buick Motor Co.

IT HAS been conservatively estimated that the safety movement has been responsible for the saving of 160,000 persons, the equivalent of a modern-sized city. The United States Steel Corporation has figured that, over a period from 1906 to 1923, 39,374 employees have been saved from serious accidents. Many other companies have shown similar results. The Buick Motor Co., has shown 1,746 accidents for 1923; 726 for 1924; and for the first six months of 1925 only 287 accidents. Still, in the face of all the safety work that has been done, you will be amazed when I tell you that out of 85,000 lives lost in the peaceful United States last year, 23,000 occurred in industry.

It must be standard practice for a workman on a drill press never to wear gloves or long sleeves. They have injured more than they have protected.

In operating a milling machine, the common source of danger is in brushing the chips from the cutter. The standard practice to be adhered to is to use a brush or stick.

Belts and gears should be always covered so that it is impossible for men to be entangled in them.

Milling-machine cutters are very dangerous when not properly handled and operated. It is possible to cover these cutters, in many cases, but more thought should be given to the design of the fixture used for holding the work to make sure that the man operating the machine does not have to expose his hands unduly to the cutter.

Lathe tools probably do not cause injury as much as drill-press or milling-machine tools, because the cutter is stationary, but there is a hazard connected with a lathe operation, and that is the flying chip or the long steel shaving. The long shaving, will, sooner or later, cause severe lacerations. The ribbon shaving can be eliminated by the proper grinding of the tool.

Brass turnings, due to their brittleness, and the high speed at which they are produced, have a tendency to fly. Many eyes are lost as a result of flying particles of metal that can be guarded against. On a brass turning job, a very simple, inexpensive guard will do the trick. It consists of a piece of sheet metal bent around the sides and top of the tool near the cutting edge and acts as a deflector.

After the belts and gears are enclosed on a punch press, there remains the most hazardous part of the machine, the point of operations, between the dies. Sweep guards, telltale gates and devices, that harness a man's hands, have been placed on presses and men in an endeavor to eliminate the accident that is occurring at the point of operation. If accidents are happening at the point of operation, why put on gate guards and telltale devices that only temporarily cover up the hazard? Will we not progress further if we can remove the hazard entirely by building a safe die for all times? A safe die not only prevents injury but speeds production because the operator, knowing that it is impossible for him to be hurt, can work with less nervousness. A man who operates a press in constant fear certainly cannot get out as much production as the man whose mind is at ease; and so in the press room the big job is safe die construction.

Grinding wheels have evolved from a hazardous operation to probably one of the safest in the machine shop. Years ago, the breaking of an abrasive wheel, with the sad news that the man operating it was killed or crippled for life, was quite an ordinary happening. We probably have a great number of wheel breakages today but do not hear from them simply because the guard that surrounds the wheel prevents any of the broken particles from flying out and striking the operator.

Tools used in woodworking machinery are all extremely hazardous due to the sharp cutting edges and the high speed at which they revolve. The hazard of the shaper can be overcome through the use of forms, properly designed, to hold the work. Jointers can be guarded, but in all events a circular head should be used in place of the old square head. Saws are easier to guard than other woodworking tools but, where it is impossible, the form for holding the stock can be used to good advantage.

There are many operations that must be performed by hand or shock tools. Shock tools, such as chisels, stamps, drills, drifts, punches and plugging tools, have not been improved to any great extent in recent years. The constant striking of a hammer on the top of these tools has a tendency to cause the material to work toward the outside and flare out, or mushroom. Succeeding blows will cause the material to be hammered out into a thin sliver, constantly working toward the circumference. A glancing blow will then easily cut off the sliver, or piece of the mushroom, causing it to fly through the air, many times doing serious damto the operator or someone standing nearby. Actual tests in one of our plants leads us to believe that the best method of dressing the tool is by using a radius instead of the straight chamfer, the amount of the radius to be between one-eighth to one-fourth of the diameter of the tool. After being ground to such specifications, the shock tool has been found to last much longer than the one that is chamfered.

Another hand tool that should receive the attention of all production men, from a safety standpoint, is the plain hammer. Making the hammer safe from the flying nail has been done and at the present time we are using, on our loading dock, a specially constructed hammer that consists of having a number of annular grooves in the face to a depth of approximately $\frac{1}{16}$ in. by about $\frac{1}{16}$ in. wide. Since we have used these hammers, we have not had any trouble with the flying nail hazard.

New Haven Exhibition Incorporates

It was announced last week at the Mason Laboratory of Mechanical Engineering, in New Haven, that in order to insure the continuity of policies and efforts and to better protect the interest of all concerned, the New Haven Machine Tool Exhibition had been incorporated under the laws of the State of Connecticut. The purpose and plans as embodied in the articles of incorporation and the by-laws are to promote the scientific development of machine tools and of other mechanical appliances and apparatus, and to stimulate interest therein and to educate the public with reference thereto by means of exhibitions from time to time of such machine tools and other mechanical appliances and apparatus.

No part of the property, assets or net income of the corporation, shall insure to the benefit of the members of the corporation. In the event of the dissolution of the corporation any and all of its assets and property remaining after the payment of its debts shall be transferred one-third to Yale University, one-third to the New Haven Chamber of Commerce and one-third to the American Society of Mechanical Engineers, this last mentioned one-third to be used for the sole benefit of the New Haven Section of the American Society of Mechanical Engineers.

At a meeting of the representatives of exhibitors held at the Mason Laboratory, a number signed tentative contracts for the 1926 exhibition, which is scheduled to be held Sept. 7, 8, 9 and 10, 1926.

A.S.M.E. Holds Session with Steel Treaters at Cleveland Convention

Keller, Spencer and Rastall present papers

The American Society of Mechanical Engineers, in co-operation with the Cleveland Engineering Society, held a session in connection with the American Society for Steel Treating, at the Hollenden Hotel, at 2 p.m., Sept. 17, 1925. The session was well attended in consideration of the other attractions of the week. Col. E. C. Peck presided.

The first paper by S. A. Keller, of the Keller Mechanical Engineering Corporation, Brooklyn, N. Y., was "Use of Machinery in Making Dies for Sheet Metal Work and Forging." It was presented by John C. Shaw, who described the advances made in the construction and operation of machines for making dies of various kinds. The illustrations showed the application of the Keller machines to many classes of work and pointed out the effect of, and the results secured from, the method of electrical control of the tracer points.

This was followed by a paper by Henry K. Spencer of the Blanchard Machine Co., Cambridge, Mass., "Recent Development in Surface Grinding," in which he pointed out how the development of grinding machines had made possible the removal of large amounts of metal at a rate that was not believed possible a few years ago. The examples shown, both of heavy work and the use of automatic grinding and gaging, attracted much attention. The use of magnetic chucks in which only the portion under the grinding wheel is magnetized, enables work to be fed to the table and removed from it automatically.

During the discussion, it was brought out that both the power required and the amount of heat developed, were dependent on the surface in contact with the wheel, and the way in which the chips could clear themselves after removal from the work. Grinding wheels in which the cutting surface is interrupted, as where the wheel is made up of sectional blocks, are said to require less power and generate less heat, on account of the space afforded for the egress of chips. One of the interesting facts brought out, was the use of motors of 60 and 100 hp. on a single grinding spindle.

W. H. Rastall, chief of the industrial machinery division of the Department of Commerce, spoke on the effect of machine development on the life of this country and of its effect on the life of countries elsewhere. He gave a few interesting statistics as to the production per man in this country fifty years ago, as compared with today—the increase being responsible for the added comforts and luxuries now enjoyed by peoples of even very moderate means.

He told of his recent visit to the Orient, of the introduction of $40,000,000 in textile machinery into China since the war, and of the effect this was bound to have on the life and development of the people of that country. He pointed out that it was the great machine development in the United States that made it possible for us to export manufactured products in spite of paying wages many times higher than the foreign countries.

Foundrymen to Study Technical Problems in Convention

The twenty-ninth annual convention of the American Foundrymen's Association to be held at Syracuse, N. Y., during the week of Oct. 5th, will present an unusual program of technical papers and committee reports for the benefit of foundry managers, metallurgists and others connected with the industry. In addition to the usual sessions covering the steel, malleable, cast-iron, and non-ferrous branches of the industry, several special sessions will be held, at which foundry refractories, apprentice training, foundry costs, management, and foundry sand testing and control will be discussed.

The technical sessions, together with the annual exhibits of foundry equipment and supplies present unusual opportunities for the foundryman to secure information of great value to him in his work. The exhibits which are to be shown in the spacious buildings of the New York State Fair Grounds will cover more space and show a greater variety of interesting features than any foundry convention since the record show of Columbus in 1920.

Seventeen sessions in all, including the joint meetings with the Institute of Metals Division of the A. I. M. E., have been scheduled. Those presenting papers represent the most prominent and successful foundry managers and research workers. In addition to American writers, papers will be presented by English and French authorities following out the exchange paper arrangement with the European Foundry Association.

Ordnance Association at Aberdeen Testing Ground

Dwight F. Davis, Acting Secretary of War, has approved the plans of the Army Ordnance Association to hold its seventh annual meeting at the Aberdeen Proving Ground, Md., on Oct. 2. In addition to members of the Army Ordnance Association the officials and membership of the National Machine Tool Builders' Association, the Franklin Institute, and the National Aeronautic Association are to attend the meeting. Officers and technical personnel of the Executive Departments, as well as civilian manufacturers and users of ordnance and related material, are planning to visit the proving ground on the occasion of the meeting for the purpose of witnessing a special demonstration of ordnance planned with a view to furnishing definite information as to the present status of ordnance development.

Current test programs at the proving ground have been arranged so that there will be a maximum of firing of ordnance of all calibers from 16-in. seacoast guns down to and including caliber 0.30 machine guns. Special demonstrations of aircraft and anti-aircraft equipment, and mobile ordnance machine shop equipment of ordnance companies in operation will be of particular interest.

To Exhibit Aeronautical Supplies at Airport

Invitations have been extended to 230 manufacturers of aeronautical supplies and accessories to exhibit their products between Sept. 28 and Oct. 3 at the Ford Airport, at Detroit, in an exposition which will be part of the program of Ford airplane racing scheduled for those dates.

The purpose of the exposition is to make known to aviators and to manufacturers what is being done in the aeronautical manufacturing field, it was stated. It is believed that there is no general knowledge among air enthusiasts where they can obtain parts and accessories when they want them. Also it will aid manufacturing concerns in locating their best markets, it is believed.

The exposition will be held on the Ford Airport Field. Buildings will be erected to house the exhibits.

The dates set for the exhibit are the days scheduled for the Ford endurance race which will start and finish on the Dearborn Field. This race is the first of its kind to be held.

The exposition, likewise the first of its kind to be held, is being sponsored by the Detroit Aviation Society and the Detroit Board of Commerce.

Canadian National Exhibit Features Machinery

While the attendance was somewhat lower than last year, owing to inclement weather, the Canadian National Exhibition, held at Toronto, Aug. 29 to Sept. 12, was an unqualified success. To this vast exposition are brought every year the products of the mine and mill, the forest and field, picturing in concrete form the natural wealth of the country and the ingenuity and splendid craftsmanship of the people. The total attendance this year was 1,491,300.

All available space in the machinery hall was occupied. There was a comprehensive showing of machinery, machine tools and supplies of all kinds. Several Canadian manufacturers reported inquiries from American visitors, and one manufacturer of machine tools sold several tools during the first few days of the exhibition.

Canada Second to U. S. in Motor Statistics

The tremendous growth of the automobile industry and the important part played by Canada in car production is illustrated in the 1925 edition of "Facts and Figures of the Automobile Industry," just published by the automotive industries of Canada.

It is stated that there are only two countries in the world, the United States and Great Britain, in which a greater number of motor vehicles are owned than in Canada; while in proportion of cars to population Canada ranks second to the United States with one car to every fourteen persons. Canadian factories have produced more than one million automobiles, and at the present time over 100,000 people are employed by the trade.

Last year, 132,460 automobiles valued at $88,480,418, were made in Canada, and of these 56,655, valued at $37,991,281, were exported. The total number of cars registered in the Dominion is 639,302, and the total amount of capital invested in production is $60,766,886.

Canada's biggest market for motor cars in 1924 was New Zealand. Australia took most of the motor trucks, while the United Kingdom took the most automobile parts and tires. Canada sent passenger automobiles to 86 different countries in 1924, including practically every British colony, every European country, and every South American republic.

More Railroad Equipment Placed in 1925

During the first seven months of this year Class I railroads placed 93,869 freight cars and 1,066 steam locomotives in service, according to the American Railway Association. The number of freight cars installed was 5,069 more than in the same 1924 period, but 3,081 less than in the corresponding period two years ago; while the new locomotives were 262 fewer than were placed in service during the same months of last year and 1,155 fewer than in the 1923 period.

Of the total freight cars, installed during the first seven months of this year, 10,578 were placed in service during July, including 4,551 box cars, 4,367 coal cars and 451 refrigerator cars.

Freight cars on order Aug. 1, totaled 26,813, compared with 52,375 on the same date last year and 86,716 in 1923.

On Aug. 1 these roads had 250 locomotives on order, against 401 on Aug. 1, 1924, and 1,772 two years ago. During July this year 139 locomotives were placed in service.

Nitrate Plant Returns Profit to Government

For the first time since 1921, when its lease to the Alabama Power Co. began, the steam power plant of United States Nitrate Plant No. 2 is operating at full capacity. Heretofore it has operated at varying capacities but not until now, to relieve the shortage of hydro-electric power caused by the severe drought of the early summer, has it been called upon for its full output of 60,000 kilowatts. This power is being turned into the inter-connected super-power system of the Alabama Power Co. to feed the states of North Carolina, South Carolina, Alabama and Georgia.

Nitrate Plant No. 2, one of the largest ordnance plants in the world, built to help make the United States independent of outside sources of nitrates for explosives manufacture, is occupying the exceptional status of earning a cash return to the Government. Under the terms of the lease, the United States receives a revenue of approximately $2,500 per day during the period of capacity operation of the plant.

This plant is not to be confused with the Wilson Dam hydro-electric power plant at Muscle Shoals.

Engineering Work Needed at Niagara Soon

Mention by Secretary Hoover recently of the urgent need of a modest amount of engineering work to prevent the recession of Niagara Falls was distorted until some of the correspondents had him saying that "beautiful Niagara Falls is in danger of total destruction through diversion of water for electrical development."

What Mr. Hoover had in mind was the need for the placing of a submerged weir or the construction of diverting islands to keep the water from concentrating on the low point of the gorge. Mr. Hoover recognizes that the diversion of water for power purposes has added to the scenic value of the falls. In recent years since the erosion at the low point has become more pronounced, the disintegration would have been hastened had it not been for the reduction in the volume of water passing over the crest.

Oil Engine Uses Less Fuel in Test

Built in the Rouge plant shops, the only oil-burning locomotive in the state of Michigan was completed recently and is now doing switching duty in the Rouge plant yards of the Detroit, Toledo & Ironton R.R. The marked advantages shown by this type of engine have already been demonstrated in decreased operating costs, more efficient firing and elimination of much smoke, dust and cinder. This latter improvement holds great weight with Ford engineers who are seeking in every possible way to cut down the pollution of the air.

The oil-burner was converted from an ordinary coal-burning locomotive by installing a fuel oil tank in the tender and oil jets in the boiler.

Already a definite saving of 22 per cent in operating costs has been shown by substitution of oil for coal. During each 16 hours, operation of this engine with coal, 16 tons of fuel were used at a cost of $73.60. Using oil, the locomotive consumes 1,000 gallons of fuel costing only $56.20.

South Feels Shortage of Water Power

To meet a shortage of power in the Southeast, which is so acute as to require limitations of street car service and part-time operation of factories, a proposal has been made to the chief of engineers that generator tests be started on the head now available.

The pool behind the Wilson dam is standing at 490 ft. above sea level—11 ft. below the operating level. The chief of engineers late in August reiterated his conviction that no more water should be impounded until the Tennessee River shows a gage at Florence.

There is now line capacity sufficient to take away 85,000 kw. from Muscle Shoals. The steam plant is producing 60,000 kw., its maximum capacity. If the generators were tested with the present head they could be operated at about 50 per cent capacity. The lines now available could handle the part-capacity output of two generators in addition to that of the steam plant.

The auxiliary turbine which furnishes the power at the Wilson dam for operations on the dam itself, has been tested. This is the first unit of the structure actually to produce power.

Contest Over Freight Rates

A special committee from the Indiana State Chamber of Commerce went to Chicago recently to confer with a similar committee representing Illinois shippers on rates affecting producers and consumers of iron and steel articles in both states. These rates cover shipments between points in Indiana, between points in Illinois and between points in both states. The rates affect manufacturers of iron and steel articles in Indianapolis, Terre Haute, Ft. Wayne, New Albany, Kokomo, Anderson, Muncie, Gary and Indiana Harbor.

The present rates are the outgrowth of the Jones & Laughlin case before the Interstate Commerce Commission in which that corporation sought reductions from Pittsburgh to Indiana and Illinois consuming points and increases in rates from Indiana and Illinois producing points. The corporation set forth that under the old scheme of rates it was excluded from a fair competition in Indiana and Illinois territory. The Indiana chamber of commerce appeared in this case in behalf of the Indiana consumers who used Pittsburgh steel in favor of the reduced rates from Pittsburgh, but opposed for the producers in Indiana and Illinois the increases sought by the Jones & Laughlin corporation.

Officers of National Museum

The National Museum of Engineering and Industry has announced the election of the following officers to serve during the coming year: Samuel Insull, president; George E. Roberts, treasurer; H. F. J. Porter, secretary.

The trustees are: John R. Freeman, George T. Seabury, George C. Stone, Dr. H. Foster Bain, L. P. Alford, Fred R. Low, John W. Leib and E. H. Hubert.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry based on current developments

By Theodore H. Price
Editor, *Commerce and Finance, New York*

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IN ITS breadth and persistence the present rise on the New York Stock Exchange is almost, if not entirely, without precedent. There have been some minor reactions but the prevailing tendency has now been upward for more than two years and last week the movement seemed to have acquired additional impetus.

The veterans of Wall Street are not participants in it. Their pre-war experience makes them cautious at the prevailing price level and most of the buying is being conducted by the younger generation who have come to the front since Germany marched into Belgium, and are accustomed to the sensational ups and downs that have been characteristic of the stock market for the last ten years.

If it has any philosophic basis the optimism of this younger generation is due to the alleged increase in America's wealth, the belief that the existence of the Federal Reserve Banks makes a money panic impossible, and the high wages and prices that are so willingly paid. These are cheerful generalizations but like all generalizations they lack precision.

Therefore it may be well to analyze them for it is not too much to say that American business is now taking its tone from the stock market, and that a reversal in the trend of the latter would be almost certain to react upon the former.

Taking the much talked of increase in our national wealth first it may be pointed out that it is measured in dollars whose value as expressed in terms of consumable commodities is much less than it was before the war. Put simply, $1 must now be paid for what cost 60 cents in say 1913. Reckoned in percentages the appreciation in the money value of commodities is about 66 per cent. And this percentage applied to the census estimate which put the national wealth in 1912 at 186 billion of the dollars then current indicates that we ought now to be worth 310 billion of the dollars presently in circulation, even if there had been no additional increment for other reasons or from other sources.

Therefore it is somewhat disappointing to find that in its latest estimate the census puts our national wealth in 1922 at only 320 billion of the dollars now in circulation and that as measured by the money of today the nation was worth only $10,000,000,000 more in 1922 than in 1912.

Unfortunately it is impossible to bring the comparison up to date as the census estimates of the national wealth are issued only once in a decade, but the figures adduced are sufficiently recent to afford convincing evidence that the real increase in the nation's wealth has been grossly exaggerated.

That the value of our exports largely exceeded the value of our imports during the war is admitted, and that our profits during this period were enormous is also admitted. But an extravagant man may impoverish himself even though he have a large income and that is what America seems to have been doing according to the statistics.

Because prices have advanced concurrently the higher wages paid have not brought any increase in purchasing power but the general "markup" has made us all *feel richer*, and we have bought accordingly for cash or on credit until it is now estimated that we owe over four billion dollars for automobiles, talking machines, radios and furniture bought on the installment plan.

Like a still, small voice crying out in the wilderness comes the recently issued warning of the National Credit Men's Association, in convention at Atlantic City, against "the peak of installment credits" which has grown up in recent months. In effect they say that fictitious purchasing power based on the extension of easy credits by banks for long periods cannot be maintained forever, and, unless held within reasonable limits, must do harm.

It is assumed that the Federal Reserve Banks, with their large gold reserves make an old-time money panic impossible. So they do, but they cannot prevent the decline in prices that is sure to come when something happens to change sentiment and the sellers outnumber the buyers.

It may be well to keep an eye on the figures of our foreign trade. For August they show imports that are $120,000,000 over last year, and an excess of exports amounting to but $8,000,000 against $76,000,000 last year. For the last three months exports exceed imports by only $18,000,000 as compared with $105,000,000 last year.

It must, however, be admitted that the week's record is upon the whole satisfactory. The trade turnover has been fully up to expectations. The commodity markets have had their usual ups and downs but none of them call for special comment.

It will take some major happening of a sensational character to disturb the prevailing optimism and until it is disturbed the predominant tone and tendency will probably continue to favor the adventurous. Meanwhile America continues to lend money abroad. A loan of $25,000,000 to a German Land Bank was heavily over-subscribed and several other foreign loans of importance are being arranged for. These transactions bespeak the confidence that is felt in the renaissance of Europe and the continued ease of money in this country.

What's Doing in Industry

There is no appreciable change in the machine tool and machinery markets from that reported in the past two weeks. Business is best characterized as spotty, orders coming in from a wide territory and calling for a variety of tools and shop equipment.

The automobile industry has not finished its buying for new plants and extensions, and Detroit continues to be the center of activity. Cincinnati reports an increased demand for tools and also a greater number of inquiries than last week. In Chicago the dealers report a satisfactory condition, with current business about 40 per cent ahead of the same period of last year.

Development of mining projects in Indiana has brought new business to dealers in Indianapolis, and inquiries are more numerous. New York reports a stirring of export business with Germany and Italy, while Buffalo admits a better condition than has prevailed in several months. Canada expects better fall business from industrial sources that are now planning increased production.

Despite fluctuations in the stock exchanges, the week's record in business is on the whole satisfactory. Trade turnover is up to expectations and the commodity markets show no special development worthy of mention.

The Industrial Review

Progress of the machinery and machine-tool business in various parts of the country

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

Indianapolis

Continued demand for machinery and tools continues to feature the local market. It is apparent that fall business will be considerably better than last year. One of the brightest spots now is the coal situation. Mines which have been down for months are opening and others are making ready for early openings. The demand for machinery and tools has been unusual from this field and in case the anthracite strike is prolonged, the demand will increase, for most mines have purchased only what is absolutely necessary to open their properties and as soon as they build up surpluses of money, replacements will be made. It has been three or four years since Indiana mines have made any but necessary installations.

More business is coming from the automobile field. Local factories are working steadily. A good demand continues to come from the furniture factories. Local manufacturers report a continued demand for machinery for lumber factories. Demand from the farm implement field has diminished somewhat, but most of these factories are expected to be back in production later in the fall.

Jobbers of used machinery report a little increase in their business, but it still remains slow as compared with the same period of last year.

Cincinnati

An increased demand for machine tools in the past week is reported by Cincinnati manufacturers, and although this is not large, it is enough to give encouragement. Some orders received were for a number of tools, but most of the sales were of single pieces of equipment.

A steady demand for replacements is reported as coming from machine tool users in various industries. Local selling agents report that concerns in the metal trades are becoming more active and that purchases and inquiries from this source are showing a gradual increase.

The greatest buying in the past week has been by concerns in the automotive industries, and inquiries received indicate that this business will increase. Railroads have done some buying, but this has been largely confined to single tools.

There has been no tendency toward localization of orders and inquiries. The general opinion of manufacturers and selling agents is that the market is growing more receptive, with orders following inquiries more quickly.

Because of good-sized orders received, a few manufacturers have increased their working forces.

Chicago

Little change in the condition of the machine tool market from last week is reported. Some dealers speak of business as holding its own, and seemingly are not expectant of any activity in the sale of their specialties until later in the year. Others regard the situation as decidedly encouraging, the inquiries they have received forecasting an excellent fall trade.

As compared with this time last year, practically all machine tool dealers and manufacturers representatives agree that the business done during August, and up to the middle of September, is far in advance of the same period in 1924, one concern estimating its increase as approximating 40 per cent.

No railroad inquiries of importance have developed during the week, such inquiries as are received being from industrial plants. This also applies to the automotive industry.

The Youngstown Sheet and Tube Co. is reported to be in the market for a number of machine tools for its Indiana Harbor plant, but it is not thought Chicago houses will benefit therefrom to any extent.

Buffalo

Machinery trade conditions here indicate a slight increase in business activity over that indicated two weeks ago. New business shows a healthy and normal increase for the season and seems to reflect general business conditions accurately.

Inquiries are somewhat on the increase and there has been some business, although nothing of a special nature. The chief activity reported is on small tools and some standard equipment.

One company reported the sale of some small tools in Germany and some gratifying orders from its Pacific coast representative.

The demand for road equipment and contractors machinery and equipment is the one low factor in the local situation, but this is seasonal and is not as depressing as has been the case in some corresponding seasons in recent years.

There is little activity in railroad equipment at present.

The electrical equipment people report a normal business and a slight increase in activity over that of two weeks ago.

Buffalo industrial conditions are the best they have been in many months and equipment men who are leaders in the field feel confident that a good streak of business is in sight for this autumn.

Detroit

No signs of a slackening in the sales of machinery and machine tools in Detroit and surrounding industrial centers have appeared upon the business horizon as yet. Everyone seems satisfied with the trend of things during the past few weeks, and none anticipate any serious let-up in the trade for some weeks to come.

While purchases by the motor car plants exceed those in any other line, there are evidences that other manufacturing establishments share the same optimistic outlook as that prevailing among automotive executives.

The Ford Motor Co., after a slight lull which occasioned some concern in certain quarters, has re-entered the lists of heavy buyers of machinery, the larger portion of which is dies, as well as equipment for the new forge nearing completion at the River Rouge plant. The Briggs Manufacturing Co. is also making extensive purchases of dies and tools.

The Hudson Motor Car Co., the Chrysler Corporation, and the Cadillac Motor Car Co., all running to peak production, are replacing much of their antiquated machinery and are installing more modern equipment.

The Packard plant has practically finished the expenditure of hundreds of thousands of dollars for automatic machinery. Dodge is continuing its expansion program, and is placing the remaining orders for tools and machinery in the light hammer shop and the die-making shop.

The ground steel parts division of the Chevrolet plant, which makes piston pins, tappets and other hardened parts, is running on a night and day schedule of 19 hours daily. The plant recently junked all tool equipment used in the manufacture of steel parts, replacing it with more modern machinery.

Production of carburetors for automobiles to be manufactured by any unit of the General Motors Corporation has been started at the Bay City plant of the Chevrolet Motor Co. Preparations for this work have been under way for several months. A full complement of automatic machinery has been installed, tools and fixtures have been designed and sample carburetors have already been turned out.

At Owosso, Mich., the Standard Machinery Co. has finished rebuilding its plant which was destroyed by fire. New machinery has been purchased and production will be resumed as soon as installations are completed.

The Michigan Central R.R. has come into the market for several pieces of machinery and tools for its shops. This is the first purchasing done by this road in some time.

New York

Buying activity in the local market has not shown any appreciable increase in the past week. Orders have appeared with ordinary regularity and new inquiries are about the only outstanding feature of the period.

Industrialists and railroads have come into the market for new machine tool equipment, but most orders are for single pieces for special purpose work. There is a marked tendency reported toward higher prices. Dealers state that buyers are coming to realize that highly specialized machines must naturally cost more than standard products, and there is less resistance from the cost angle.

Export business, particularly with Germany and Italy has taken on new life. Machine tool sales to German manufacturers have increased favorably this month.

The market in Russia is reported to be quite active in the demand for high-production machines, but nothing definite can be learned as to the source of the orders or the amounts involved. It is stated that credit conditions are becoming a little less difficult to overcome in getting this business.

Railroads in this district continue to buy tools for replacement. Several radial drills, two 50-ton hydraulic bushing presses and a large turret lathe were among the orders recorded last week. Two new inquiries, one from the Delaware & Lackawanna R.R. and one from the Long Island R.R., appeared in the last ten days. Both call for substantial requirements for shop equipment. Present indications are that September sales will not exceed those of August.

Canada

Present indications are that the metal-working industry in Canada will experience an active final quarter. Pulp and paper, lumbering, power development and mining are providing much increased business for supply firms and engineering plants. Buyers in the metal markets are showing increased interest in future supplies, while continuing their steady purchasing for present needs.

The International Harvester Co. has made a contract with the Hamilton hydro-electric system for the supply of additional horsepower. This contract indicates that the company has received a number of large orders recently. Two large furnaces which have been standing idle for some time, have been restarted.

News of the Automotive Industries

The Ford Motor Co. orders for new model cars total approximately 250,000. While production at the Ford plant is still below normal owing to the model changes, output last week approached 5,000 a day and by October 1, the company expects to reach its normal production schedule of 7,000 cars and trucks a day.

The Chevrolet Motor Co. will increase production schedule during September more than 16 per cent over the production program originally planned. The new schedule calls for 53,165 motor cars and trucks in September, a Chevrolet record for that month and only 3,078 less than the highest production month in the history of the company. Both day and night shifts have been augmented to maintain the new schedule.

The Willys-Overland Co.'s incoming orders the last week have averaged better than 1,000 cars a day. September production will probably reach 21,000 cars and the October program now calls for 26,000 cars. Every car that can be built in the next sixty days is certain to be sold.

The Hudson Motor Co. is producing at the rate of 1,200 cars a day; Chrysler at 800; Buick 1,100; Chevrolet 2,400; Packard 150; and Cadillac 100. Automobile company statisticians estimate September output of all companies, excluding Ford, will closely approach the high records of last March and April, but including Ford production the total will be considerably less on account of the lower Ford output due to model changing.

The Olds Motor Works has placed every department on overtime to meet demand for the new Series D cars recently introduced. With schedule calling for 5,000 sedans and coaches alone this month, and deliveries paralleling factory production, it appears all September production and sales records will be broken. Advance orders for October and November delivery insure peak production throughout remainder of the year.

What the Railroads Are Doing

Railroad equipment orders reported last week included one from the Baltimore & Ohio for 1,000 steel underframes, placed with the Standard Steel Car Co. The pressed Steel Car Co. booked 387 steel underframes for the Fruit Growers Express, while the Kansas City, Mexico & Orient ordered fifty hoppers from the Mount Vernon Car Manufacturing Co. Armour & Co. have entered the market for 300 steel underframes.

The South Australian Railways placed an order with the J. G. Brill Co. for twenty-five gasoline rail cars designed for steam railroads on which passenger traffic is light. Orders for more than sixty cars of this type have been received from domestic and foreign railroads. The Union Pacific is inquiring for 40,000 tons of rails and the Chicago & North Western for 36,000 tons.

The Chicago, Rock Island & Pacific Ry. has purchased from Mack Trucks a gasoline motor car embodying the latest features in economical local passenger transportation. This "Mack Rail Car" will be put in operation on the Missouri division between St. Joseph and Altamont, taking the place of a two-car steam train.

The car is the result of three years' study of railway requirements. Present type is practically regular equipment, and can be coupled into two, three and four-car trains with 90 hp. gasoline motors on each truck, all electrically controlled from one central point.

Stockholders of the Buffalo, Rochester & Pittsburgh R.R. have approved the lease of their property to the Delaware & Hudson for 999 years upon the agreement of the D. & H. to assume the fixed charges of the road and pay 6 per cent interest on the common and preferred stocks. The terms of the contract were approved last May by the directors of the road, and by the stockholders of the Delaware & Hudson on Sept. 8. Application to the Interstate Commerce Commission will be made soon for its approval.

Personals

HARRY F. WAHR has been elected president of the Mesta Machine Co., succeeding the late Frederick E. Mesta. Mr. Wahr was formerly vice-president of the company. J. O. Horning and Lorenz Iverson have been elected vice-presidents of the company, and John Edwards has been appointed assistant to the treasurer.

N. A. MEARS has been appointed general manager of the plant of the Chicago Forging and Manufacturing Co., Chicago.

HOWARD COONLEY, of the Walworth Manufacturing Co., Boston, has been appointed chief of the First Chemical Warfare District, which has its headquarters in Boston.

E. B. STANLEY has been elected president of the American Laundry Machinery Co., succeeding the late Robert M. Burton.

JOHN T. LLEWELLYN has been elected president of the Chicago Malleable Castings Co., succeeding his brother the late Silas J. Llewellyn.

GEORGE J. MEAD has joined the engineering staff of the Pratt & Whitney Aircraft Co., of Hartford, Conn. Mr. Mead was formerly associated with the Wright Aeronautical Corporation at Paterson, N. J.

FRANK L. ALLEN has resigned as sales engineer with the E. A. Kinsey Co., of Indianapolis, and will shortly become associated in a similar capacity with the E. L. Essley Machinery Co., of Milwaukee.

C. A. MAGRATH, of Ottawa, chairman of the International Waterways Commission, has been appointed chairman of the Ontario Hydro Electric Power Commission, succeeding the late Sir Adam Beck. C. ALFRED MAGUIRE, former Mayor of Toronto, has been appointed the third member of the commission. The new chairman has devoted many years of his life to public service. In 1911 he was appointed to the International Joint Commission. In 1913 he was chairman of a temporary commission created by the province of Ontario to investigate and report upon a comprehensive system of highways.

C. VINCENT MASSEY, president of the Massey-Harris Implement Co., and a director of several other financial and commercial organizations, has been appointed minister without portfolio in the Canadian federal government.

J. D. JONES, general manager of the Algoma Steel Corporation, has been appointed a director of that firm, of the Lake Superior Corporation and subsidiaary companies, succeeding the late Thomas Gibson.

H. W. ALGER has resigned as vice-president and general manager of the Lansing, Mich., plant of the Durant Motors Co.

FRED MCDONEL, Jr., of Lansing, Mich., has been appointed production manager of the Summit Screw Co., of Chicago.

ALFRED O. KAUFFMANN, president of the Link-Belt Co., will again be chairman of the Indianapolis Community Fund Campaign for 1926.

FABIO SERGARDE, formerly chief engineer of the Olds Motor Works, has joined the engineering staff of the Reo Motor Car Co., of Lansing, Mich.

W. A. TAYLOR and F. P. O'KEEFFE, sales engineers, have been transferred to the Detroit office of the E. W. Bliss Co. Mr. Taylor, who was with the Brooklyn plant for ten years, in the engineering department, has become sales engineer for the Detroit territory. Mr. O'Keeffe, who has been in the Eastern sales department since 1921, has taken over the sales of the company in Michigan outside of Detroit. WILLIAM HODSON, JR., who has been Detroit salesman for the last five years, continues in the same capacity.

G. HERBERT WHITTINGHAM, of the Monitor Controller Co., Baltimore, Md., prominent designer of automatic-control equipment for electric-motor drives, has undergone a major operation, and is now recuperating at the Union Memorial Hospital, Baltimore. He appears to be recovering satisfactorily and is expected out soon.

L. M. ZIMMER has been appointed general sales manager of the Linde Air Products Co., and of the welding gas division of the Prest-O-Lite Co., Inc., succeeding L. M. Moyer, who resigned August 1. Mr. Zimmer entered the employ of the Linde company nine years ago as a salesman. Most of the time he has represented the company in the Central-West, coming to New York early in 1924 to act as assistant to the general sales manager.

S. HORACE DISSTON, vice-president in charge of sales of Henry Disston & Sons, Inc., Philadelphia, addressed the Purchasing Agents' Association of Pittsburgh at its regular meeting and dinner Sept. 15. During the address a three-reel motion picture showing how Disston saws, tools and files are made was exhibited.

Business Items

The Independent Pneumatic Tool Co., manufacturers of "Thor" pneumatic tools and electric tools, announces the opening of a branch office at 288 East Water St., Milwaukee, Wis. A complete stock of tools, spare parts and accessories will be carried. This branch will be in charge of G. H. DuSell, an experienced pneumatic and electric tool man, who has traveled in the Milwaukee District in the interest of the company for a number of years.

The Eldredge Electric Manufacturing Co., of Springfield, Mass., has been acquired by R. W. Ellingham, formerly works manager of the Indian Motorcycle, Co., who, with his son Harold, has formed a new company known as the Eldredge Electrical Manufacturing Co., Inc., to continue the production of small electrical products.

Hermann Associates, Inc., has been organized with offices at 610 Best Bldg., Rock Island, Ill. The company was formerly known as the C. C. Hermann Co. A general consulting practice in mechanical and industrial engineering will be carried on by the new firm. A fully equipped laboratory and machine shop will be erected this fall. The officers of the corporation are: C. C. Hermann, president; W. F. Meiburg, vice-president; J. F. Hermann, secretary; H. E. Hermann, treasurer.

The machinery manufacturing plant of Detrick & Harvey, in Baltimore, owned and operated by the Bethlehem Steel Corporation, has been sold to a group of Baltimore manufacturers headed by J. W. Neidhardt. The new owners will incorporate the company under the laws of Maryland and will operate the plant in the manufacture of special machinery. Mr. Neidhardt will be president and will have active charge of the new organization.

The Ex-Cell-O Tool and Manufacturing Co., of Detroit, has appointed the following representatives: The E. D. Bishop Co., Cleveland, Ohio; A. E. Coburn, Crafton, Pittsburgh, Pa.; James O. Coleman, St. Louis, Mo.; Albert T. Fisher, Cincinnati, Ohio; R. W. Hansen, Chicago; the Kemp Machinery Co., Baltimore, Md.; the A. V. Wiggins Co., Syracuse, N. Y.

Eicher & Bratt, of Seattle, have been appointed sales representatives in the states of Oregon, Washington, Idaho, and in Alaska, for control equipment manufactured by the Electric Controller and Manufacturing Co., of Cleveland, Ohio.

A branch office of the Standard Machinery Co. of Owosso, Mich., has been established in the Book Bldg., Detroit.

The Kuhlman Electric Co., of Bay City, Mich., announces the appointment of the D. H. Braymer Equipment Co., 727 W. O. W. Bldg., Omaha, Neb., as district representatives in Iowa and Nebraska.

Plans for turning the British Empire Steel Corporation's plant at Trenton, Nova Scotia, into a steel specialty plant are now under advisement. The plant will be equipped with machinery to manufacture smaller articles used in the steel trade.

Among the incorporations granted in Canada during the past two weeks were: The Canadian Foundry Supplies and Equipment, Ltd., capital $500,000, with headquarters at Montreal; the Canadian Atlas Steels Ltd., capital $1,500,000, headquarters at Welland, Ontario; the Eastern Canada Steel and Iron Works, Ltd., Quebec.

Alfred Herbert, Ltd., Coventry, England, has received an order from the Ashanti Goldfields Corporation, L.d., to supply six Atritor coal pulverizing units to fire Edwards furnaces for roasting gold ore. Each of these machines will be capable of pulverizing 500 lb. of coal per hour and will be driven by d.c. motors of totally enclosed type, both Atritor and motors being mounted on cast-iron bedplates.

The Foskett Brown Manufacturing Co., of Nashville, Tenn., has recently incorporated for $100,000, and will start shortly the manufacture of a number of metal products such as radiator caps, valves, temperature control apparatus and several power specialties. Foskett Brown is president and treasurer; and C S. Brown is vice-president.

F. H. Hopkins & Co., Ltd., of Montreal and Toronto, has been appointed sole representative and distributor in eastern Canada for the Caterpillar Tractor Co., of California.

The B. Greening Wire Co. has acquired the Canadian and British rights for manufacturing and distributing the automobile chains of the Hoff Metal Products Co., New York.

The Romeo Foundry and Machine Co. has been organized in Romeo, Mich. The company has leased the plant of the Holmes Foundry Co. H. D. Rumsey is president, and Charles E. Brinker is vice-president and general manager.

The sale of the Wallace Machine Works, Indianapolis, to the Service Tool Works has been announced. Henry C. Gray is head of the Service company which will specialize in the manufacture of dies and punches.

Obituaries

LOUIS SACKS, president of Louis Sacks, Inc., operator of several foundries in the East, died at his home in Newark, N. J., on Sept. 11. Mr. Sacks had been connected with the foundry and machine business for half a century, and was one of the owners of the Newark Malleable Iron Works.

WILLIAM H. HEULINGS, JR., vice-president and general manager of sales of the J. G. Brill Co., of Philadelphia, died at his home in that city on Sept. 14. He was 56 years old.

ALBERT STOPPARD, chief engineer of the Canadian Pacific Ry., Ogden shops, died at Calgary, Alberta, recently.

Trade Catalogs

Furnaces, Electric Resistance. Electric Furnace Co., Ltd., 17, Victoria St., London, S.W. 1, England. Pamphlet D describes the uses and methods of use of the electric furnace. The advantages of its application to vitreous enameling and annealing are especially discussed.

Lathes, Turret. Foster Machine Co., Elkhart, Ind. A series of circulars are being published relative to production engineering by this company. They deal with money-saving set-ups on the turret lathe and screw machines featuring Foster-Barker chucks.

Tools, Precision. The Hanson-Whitney Machine Co., Hartford, Conn., has published a 96-page catalog of their products, including taps, gages, hobs, worms, precision screws and thread-rolling dies.

Tables are included in the catalog showing standard hand-tap dimensions as well as those of several other threads. The last 14 pages of the catalog are devoted to these tables of American, British, French and International Thread standards.

Trucks and Tractors, Electric. The Crescent Truck Co., Lebanon, Pa. The 1925-26 edition of the Crescent general catalog contains 40 pages, 8 x 11 in., of well illustrated descriptions and specifications of trucks, tractors and cranes produced by this company. The general appearance of the catalog is artistic and the illustrations that are included are interesting applications of the various models produced by this company.

Drill, Portable Air. The Buckeye Portable Tool Co., 135 Wayne Ave., Dayton, Ohio, has published a circular to describe the principles of operation of the Hercules No. "OO" drill. Illustrations of the drill in operation are shown. The Hercules power unit has also been applied to portable grinders and buffers and the tools are manufactured in several sizes.

Air Compressors. Sullivan Machinery Co., 429 People's Gas Bldg., Chicago, Ill. Bulletin No. 77-N is devoted to the description of the "WK-312," "WK-314," "WK-32," and "WK-34" portable air compressors. These models are gasolene-engine driven and belt driven. Many illustrations show the applications and set-ups for which the compressors may be used and tables give the specifications and capacities of the different models. Short sketches of other Sullivan equipment are included in the last four of the 32 pages. All of the details of the compressor, equipment, mountings and power are systematically summarized.

Broaching Machines. The J. N. Lapointe Co., New London, Conn. The No. 4-W variable-speed hydraulic broaching machine is described in a circular that covers the operating details of the tools. The illustrations consist of line drawings and photographs.

Couplings, Shaft. The Farrel Foundry & Machine Co., Buffalo, N. Y., has issued folder C to show the advantages and construction of the Sykes universal-shaft coupling. Tables give the specifications and capacities of these couplings.

Drillpointers. The Oliver Instrument Co., Adrian, Mich., has issued a circular bringing out the features of the Oliver drill-pointer and point-thinner. The advantage of and reasons for the use of these machines is discussed.

Electric Controllers. Monitor Controller Co., 500 East Lombard St., Baltimore, Md. A folder describes the Monitor 230-volt automatic starter installed on a 300-hp. drive. This starter is one of their "Just Push the Button" line of controllers.

Gages, Pressure and Vacuum. The Brown Instrument Co., 4501 Wayne Ave., Philadelphia, Pa. Catalog No. 74 covers various styles of Brown recording pressure and vacuum gages. Illustrations of different models, charts and installations are shown in this 32-page catalog. Various other instruments and equipment are mentioned also in this catalog. The descriptions of the instruments are quite thorough and clearly written and the typography is excellent.

Paint, Galvanized Iron. Goheen Corporation of New Jersey, Newark, N. J., New York office, 331 Madison Ave. Galvanum is the trade name of the paint manufactured by this corporation which is intended especially for application to galvanized iron surfaces. A circular contains a color scale, description and directions for its application.

Speed Reducers. Boston Gear Works Sales Co., Norfolk Downs, Mass. Form No. C6-25 lists the types of Boston speed reduction units ready for immediate delivery. Boston standardized hardened spur pinions are included in this circular.

Speed Reducers. Foote Bros. Gear & Machine Co., 242-252 North Curtis St., Chicago, Ill. Catalog No. 26, eighty 8½ x 11-in. pages, has been published by this company to cover the IXL Speed Reducers. The special features and purposes of the different models is discussed and tables list their dimensions. The IXL, Ajax, Grundy and Francke flexible couplings are also described and priced in this book, as are their replacement parts and those of the speed reducers.

Many formulas and methods of computation relative to the subject are given and practical examples worked out. Several pages are devoted wholly to photographs of actual installations of this equipment.

Tachometers, Indicating and Recording. The Brown Instrument Co., 4501 Wayne Ave., Philadelphia, Pa. Catalog No. 44 illustrates and details several types of Brown tachometers as well as the charts to be used in connection with them. Prices of each model are included with the individual descriptions.

Pamphlets Received

A New Method of Balance Sheet Analysis. Published by the Metropolitan Life Insurance Co., 1 Madison Ave., New York, N. Y., No. 4 in the series of Management Methods prepared by the Policyholders' Service Bureau. This 16-page booklet describes the new method of balance sheet analysis worked out by the Robert Morris Associates for securing a more reliable and informative picture of a company's financial condition and affairs.

The Homo Method for the Drawing of Steel. Published as Catalog No. 93 by the Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa. This pamphlet describes the difficulties that are encountered in the drawing of steel and the correct methods of practice and equipment used in the process. A description and price list of the Homo equipment are included.

Directory of Placement Services in American Colleges and Universities. Published by the Personnel Research Federation, Inc., 40 West 40th St., New York, N. Y. This directory lists the principle colleges and nearly all the universities of the country by states and gives the names of the superintendents of their respective employment or placement offices.

The Dragon. Machine Tool Number. Published by the Fafnir Bearing Co., New Britain, Conn. This pamphlet lists the applications and advantages of ball bearings on machine tools specializing on the Fafnir bearing mountings.

Forthcoming Meetings

National Safety Council. Fourteenth annual safety congress, Cleveland, Sept. 28 to Oct. 2. A. A. Mowbray, director, 168 N. Michigan Ave., Chicago.

American Gear Manufacturers' Association. Semi-annual meeting, Oct. 1, 2 and 3, West Baden Springs Hotel, West Baden, Ind. T. W. Owen, secretary, 2443 Prospect Ave., Cleveland, Ohio.

American Foundrymen's Association. Annual meeting, State Fair Grounds, Syracuse, N. Y., Oct. 5 to 9. C. E. Hoyt, secretary, 140 So. Dearborn St., Chicago.

Motor and Accessory Manufacturers' Association. Fall meeting, Prince Edward Hotel, Montreal, Canada, Oct. 14 to 16. M. L. Heminway, general manager, 250 West 57th St., New York.

National Industrial Advertisers' Association. Annual meeting, Chalfonte-Haddon Hall Hotel, Atlantic City, N. J., Oct. 19 to 21. W. A. Wolff, chairman, the Western Electric Co., 195 Broadway, New York.

Management Week. Conducted jointly by five societies—The American Society of Mechanical Engineers, The American Management Association, The National Association of Cost Accountants, The Taylor Society and the Society of Industrial Engineers. Week of Oct. 19 to 24. W. L. Conrad, of the A. S. M. E., is chairman of the joint committee.

American Welding Society. Exposition of welding equipment and accessories, Massachusetts Institute of Technology, Cambridge, Mass., Oct. 21, 22 and 23. R. L. Browne, chairman, 141 Milk St., Boston, Mass.

American Society of Mechanical Engineers. Annual meeting, Engineering Societies Bldg., 29 West 39th St., New York City, Nov. 30. to Dec. 3. Calvin Rice, secretary, Engineering Societies Bldg., New York.

National Exposition of Power and Mechanical Engineering. Fourth annual event, Grand Central Palace, New York City, Nov. 30 to Dec. 5. Charles F. Roth, manager, International Exposition Co., Grand Central Palace, New York City.

American Association for the Advancement of Science. Annual meeting, Kansas City, Mo., Dec. 28, 1925, to Jan. 2, 1926. Burton E. Livingston, secretary, Smithsonian Institute Bldg., Washington, D. C.

The Weekly Price Guide

Rise and Fall of the Market

Iron and Steel—Small lot buying characterizes the iron market; price of No. 2 fdry. Southern is up 50c. per ton from last week's level, making the second consecutive rise of this kind in two weeks. Coke continues upward. Steel shapes are firmer at $1.90@$2; bars are at about the same level and plates remain at last week's quotations of $1.80@ $1.90 per 100 lb., Pittsburgh. Tin plates, tubular goods and light rails remain firm and in good demand.

Non-Ferrous Materials—Lead, zinc and antimony steady; slight weakness reported in copper; tin market down here and abroad, comparing the current situation with that of Sept. 11. Linseed oil rose 2c. in Cleveland and 3c. per gal. in Chicago, during week. Belting prices are firmer.

(All prices as of Sept. 18)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$23.05
Northern Basic	22.27
Southern Ohio No. 2	22.77
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	27.37
BIRMINGHAM	
No. 2 Foundry	19.50
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	22.26
Virginia No. 2	29.17
Basic	21.16
Grey Forge	....
CHICAGO	
No. 2 Foundry local	22.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	25.55
PITTSBURGH, including freight charge ($1.76) from Valley	
No. 2 Foundry	20.77
Basic	20.77
Bessemer	20.77

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.75
Cleveland	4.90@5.00
Cincinnati	5.00@7.50
New York	5.00@5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	New York	Cleveland	Chicago
No. 10	2.25@2.30	3.89	3.00	3.50
No. 12	2.30@2.35	3.94	3.05	3.55
No. 14	2.35@2.40	3.99	3.10	3.60
No. 16	2.45@2.50	4.09	3.20	3.70
Black				
Nos. 17 to 21	2.90@3.00	4.15	3.60	3.80
Nos. 22 to 24	2.95@3.05	4.20	3.65	3.85
Nos. 25 and 26	3.00@3.10	4.25	3.70	3.90
No. 28	3.10@3.20	4.35	3.80	4.00
Galvanized				
Nos. 10 and 11	3.20@3.30	4.35	4.00	4.00
Nos. 12 to 14	3.30@3.40	4.45	4.10	4.10
No. 16	3.45@3.55	4.60	4.25	....
Nos. 17 to 21	3.60@3.70	4.75	4.40	4.40
Nos. 22 to 24	3.70@3.85	4.90	4.55	4.55
No. 26	3.90@4.00	5.05	4.70	4.70
No. 28	4.20@4.30	5.35	4.95	5.00

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	53%	39%	55½%	43½%	54%	41%
3½ to 6 in. steel lap welded	48%	35%	53½%	40½%	51%	38%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4% less 5%. Cast iron, standard sizes, 36-5% off.

Size, Inches	List Price per Foot	Diameters Inches — External	Diameters Inches — Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following base discounts are on 20 gauge or .035-in., round, cold-drawn tubing, ¼-in. to 1-in., O.D., weighing 0.17 lb. to 0.36 lb. per ft. Cutting charge per 100 cuts, $1.50 to $1.58:

O.D. Inches	List Price per ft.	Differential Discount	O.D. Inches	List Price per ft.	Differential Discount
¼	$0.15	50%	⅞	$0.18	35%
⅜	.16	45%	1	.19	31%
½	.17	40%			

NOTE—The discounts are to be lowered by the following differentials in the case of regular .10-.30 carbon: 25,000 ft. or over, 83; 15,000 to 25,000 ft., 82; 5,000 to 15,000 ft., 81; 1,000 to 5,000 ft., 80; less than 1,000 ft., 79.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.00	....	4.00@4.65
Spring steel (light) (base)	7.00	6.00	6.00
Coppered Bessemer rods (base)	6.05	....	....
Hoop steel	4.49	3.85	4.15
Cold rolled strip steel	6.35	8.25	6.80
Floor plates	5.55	5.60	5.50
Cold drawn shafting or screw	4.15	3.80	3.60
Cold drawn flats, squares	4.65	4.30	4.10
Structural shapes (base)	3.34	3.20	3.10
Soft steel bars (base)	3.24	3.10	3.00
Soft steel bar shapes (base)	3.24	3.11	3.10
Soft steel bands (base)	3.99	3.20	3.65
Tank plates (base)	3.34	3.40	3.10
Bar iron (3.00 at mill)	3.24	3.21	3.00
Drill rod (from list)	60%	55%	60%

Electric welding wire, New York, 5/32, 8.25c.; ¼, 7.85c.; 5/16 to ½, 7.35c. per lb.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			15.50
Tin, 5-ton lots, New York			59.75
Lead (up to carlots) E. St. Louis	9.25	New York	10.25
Zinc (up to carlots) E. St. Louis	7.75	New York	8.75

	New York	Cleveland	Chicago
Antimony (Chinese), ton spot	18.00	20.00	....
Copper sheets, base	22.75	22.75	22.75
Copper wire, base	20.25	17.00	16.75@17.00
Copper bars, base	21.87½	21.50	21.87½
Copper tubing, base	24.75	25.50	24.75
Brass sheets, base	19.12½	19.00	19.12
Brass tubing, base	23.75	23.75	23.75½
Brass rods, base	16.87½	16.87½	16.87
Brass wire, base	19.62½	22.50	19.62½

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminium ingots, 98 to 99%, 1–15 ton lots	28.00	28.00	28.03
Zinc sheets (casks)	11.25	11.50	11.27
Solder (½ and ½), (case lots)	39.50	38.00	38@42
Babbitt metal (83% tin)	60.00	68.50	58@63
Babbitt metal (35% tin)	28.00	22.50	30@35
Nickel (ingots) f.o.b. refinery	31.00	.....	.....
Nickel (electrolytic) f.o.b. refinery	38.00	.....	.....
Nickel (shot) f.o.b. refinery	32.00	.....	.....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Hot rolled nickel sheet (base)	52.00
Cold rolled nickel sheet (base)	60.00
Hot rolled rods, Grade "A" (base)	50.00
Cold drawn rods, Grade "A" (base)	58.00
Manganese nickel hot rolled rods "E"—low manganese (base)	54.00
Manganese nickel hot rolled rods "D"—high manganese (base)	57.00

Base price of Monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	40.00
Blocks	32.00	Cold drawn rods (base)	48.00
Ingots	38.00	Hot rolled sheets (base)	42.00
Cold rolled sheets (base)			50.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Crucible heavy copper	12.75@13.00	11.75	12.00@12.50
Copper, heavy, and wire	12.00@12.50	11.50	11.25@11.75
Copper, light, and bottoms	10.25@10.50	9.75	10.25@10.75
Heavy lead	7.75@8.25	7.25	7.75@8.25
Tea lead	6.50@7.00	4.75	6.25@6.75
Brass, heavy, yellow	7.25@7.75	7.25	7.75@8.25
Brass, heavy, red	9.50@10.00	9.75	9.25@9.75
Brass, light	6.00@6.50	6.00	7.25@7.75
No. 1 yellow rod turnings	8.25@8.50	8.00	7.75@8.25
Zinc	5.00@5.50	4.00	4.50@5.00

TIN PLATES—American Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	14x20	$11.25	$11.45	$11.50
"A" Grade:				
IC,	14x20	8.85	9.40	9.50
	Coke Plates—Primes.			
100-lb.,	14x20	6.50	6.10	7.00
	Terne Plates—Small lots, 8-lb. Coating			
IC,	14x20	7.25	6.95	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.15@0.22	$0.19	$0.20
Cotton waste, colored, per lb.	.10@.15½	.18	.17
Wiping cloths, washed white, per lb	.17	36.00 per M	.15½
Sal soda, per 100 lb. keg	2.25	2.25	2.75
Roll sulphur, per 100 lb. keg	3.75	3.75	4.50
Linseed oil, per gal., 5 bbl. lots	1.08	1.22	1.05
Lard cutting oil, 25% lard, per gal.	.55	.50	.72
Machine lubricant, medium-bodied (50 gal. wooden bbl.), per gal.	.35	.35	.26
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin. ft. per inch of width for single ply.			
Medium grade	40%	40%	30–10%
Heavy grade	30–10%	35%	30–5%
Rubber transmission, 6-in., 6 ply, $1.83 per lin. ft.			
First grade	50–5%	50–10%	50%
Second grade	50–10–5%	60–5%	50–10%

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0324	$0.0324	$0.0324
Cold finished shafting	per lb.	.0415	.0415	.0415
Brass rods	per lb	.1687½	.1687½	.15
Solder (½ and ½)	per lb.	.395	.395	.385
Cotton waste	per lb.	.15@.22	.15@.22	14@21
Washers, cast iron (½ in.)	per 100 lb.	7.00	7.00	6.50
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	3.55	3.55	3.38
Lard cutting oil	per gal.	.55	.55	.55
Machine oil	per gal.	.35	.35	.29
Belting, leather, medium	off list	40%	40%	40–2½%
Machine bolts up to 1x30 in.	off list	40%	40%	50%

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$5.46	$5.84	$5.00
Emery paper	10.71	11.00	11.90
Emery cloth	29.48	31.12	32.75
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1.49	1.41	1.40
Cloth	3.55	2.67	3.55
Fire clay, per 100 lb. bag		.60	.75
Coke, prompt furnace, Connellsville	per net ton		3.50@4.00
Coke, prompt foundry, Connellsville	per net ton		4.50@4.75
White lead, dry or in oil	100 lb. kegs	New York, 15.75	
Red lead, dry	100 lb. kegs	New York, 15.75	
Red lead, in oil	100 lb. kegs	New York, 17.25	

SHOP SUPPLIES

Machine bolts, ¼x1½-in., per 100, $1.70. Discount at New York warehouses on all sizes up to 1x30-in., 40%; 1¼ and 1¼x3-in. up to 12-in., 15%; with cold punched hex. nuts up to 1-in. dia. (plus std. extra of 10%) 30%; with hot pressed hex. nuts up to 1x30-in. (plus std. extra of 10%) 35%. Machine bolts, up to 1x30-in., with cold punched and hot-pressed hex. nuts, also button head bolts with hex. nuts are $3.60@3.75 per 100 lb. at Cleveland.

Carriage bolts, ¼x1½-in., per 100, $1.00. Discount on all sizes up to 1x30-in., 30%.

Coach and lag screws, 1½x$\frac{5}{16}$in., $2.25 per 100, less 40%.

Tap bolts, 1½x½-in., $1.00 per 100. List plus 35% at New York warehouses; with hex. heads, $4.65 per 100 lb. net at Chicago.

Bolt ends, 1x12-in., 10c. per lb., less 40%.

Nuts, semi-finished, ¼x½-in., 2c. each. Discount 70% for $\frac{5}{16}$-in. and smaller and 65% for ⅜-in. and larger.
Case hardened ¼x½-in., 6c. each, less 50%.

Rivets, button heads, ¾-in., ⅞-in., 1-in. diam. x 2$\frac{1}{16}$-in. to 4½-in., $5.00* per 100 lb. at New York warehouses; cone heads, same sizes, $5.20* per 100 lb. Rivets, $\frac{7}{16}$x1-in. and longer, 19c. per lb., less 50%. Same discount for tinned. EXTRA per 100 lb. for 1¼ to 2-in. long, all diameters, 25c.; ¼-in. dia., 35c.; ½-in. dia., 75c.; 1-in. long and shorter, 75c., longer than 5-in., 50c.; less than 200 lb., 50c.; countersunk heads, 45c.

Washers, cast iron, ½-in., $7.00* per 100 lb. at New York warehouses; ⅝-in., $6.00* per 100 lb.

*For immediate delivery from wareho.

Machine Requirements and Industrial Construction

Machine Tools and Equipment Wanted

Conn., Bridgeport—Moore Special Tool Co., 358 John St.—B. & S. No. 2 surface grinder, Carter & Hakes hand milling machine with vise, heads, vertical attachment, etc. (used.)

Kan., Leavenworth—Abernathy Furniture Co., 1513 West 9th St., Kansas City, Mo.—machinery for furniture factory here.

Md., Baltimore—A. Weiskittel & Son Co., 12th and East Lombard Sts.—60 in. open side planer with short bed 10 or 12 ft. long.

Mass., Brighton (Boston P. O.)—F. Levine, 316 Washington St.—miscellaneous tools and equipment for extensive repair and service garage.

Mass., Lowell—J. L. Kaplan, 111 Chelmsford St.—tools and equipment for proposed repair and service garage.

Mass., Lynn—P. O. Box 250—10 or 12 in. crank shaper.

Mass., Roxbury (Boston P. O.)—M. N. Tracy, 21 Lambert Ave.—miscellaneous tools and equipment for repair and service garage.

Mass., South Lincoln—J. Healey, Box 8, Route 6—small planer, saw mortiser and miscellaneous equipment for shop.

Mass., West Newton (Boston P. O.)—J. Rooney, 515 Waltham St.—miscellaneous tools and equipment for repair and service garage.

Mo., St. Louis — Wabash Railway Co., Railway Exchange Bldg., T. J. Frier, Purch. Agt.—14 x 27 ft. lathe, 24 in. rip saw, 24 in. upright drill press, 42 in. drill press, 3 ft. radial drill press, bushing press, three 18 in. lathes, air hammer, knife grinder, air drill, air riveter, pattern maker's wood turning lathe, air hoist, sensitive drill press and 32 in. shaper for shops at Decatur, Ill.

N. J., Newark—Newark Steel Drum Co., Stockton St.—hydraulic press 100 to 200 ton capacity.

N. Y., New York—W. H. Kleckner, 9 West 61st St.—Taylor spot welder 15 kva. with 30 in. horns.

O., Columbus — Columbus Consumers' Supply Co., 315 North 4th St., H. R. Gill, Pres.—loading and unloading equipment and machinery for building supply and coal yard.

O., Columbus—J. B. Litter, 244 West 9th Ave.—drill press, 24 in. lathe, air compressor, etc., for machine shop.

Pa., Pittsburgh—American Sheet & Tin Plate Co., Frick Bldg., M. S. Dennis, Purch. Agt.—16, 18, 24 and 34 in. lathes.

R. I., Providence—S. Monit, Hartford Ave. and Bowlit St.—miscellaneous tools and equipment for repair garage.

Wis., Kiel—Kiel Furniture Co.—woodworking machinery for proposed new plant.

Wis., Milwaukee—H. Schmitt & Sons, Inc., 430 Farwell Ave.—woodworking machinery, motors, etc., for shop.

B. C., Vancouver—Easterbrook Milling Co.—equipment for proposed new lumber mill to replace fire loss.

Ont., Norwich — Norwich Electric Ltd., W. Hunt, Mgr.—equipment for complete new plant for the manufacture of electric fixtures.

Ont., Orillia—Hi Lo Jacks, Ltd., Strathroy, W. Strank, Mgr.—equipment for the manufacture of lifting jacks, also interested in prices of special castings for plant here.

Que., Montreal—R. T. Gilman Co., 416 Phillips Place—electric drill.

Que., Notre Dame du Lac—L. J. Dube—tenoner and band saw machine.

Opportunities for Future Business

Ala., Birmingham — The Birmingham Electric Co., 109 North 11th St., plans the construction of a new foundry and machine shop in connection with present plant. Estimated cost $15,000.

Ark., Blytheville—Chicago Mill & Lumber Co., F. W. Schatz, 500 North Dearborn St., Chicago, Ill., plans the construction of a lumber mill including sheds, etc., here, to replace fire loss. Estimated cost $150,000.

Calif., Los Angeles—Bd. of Education, is having plans prepared for the construction of a group of buildings including a 2 and 3 story, 180 x 527 ft. main building and 1 story, 70 x 150 ft. shop building for Horace Mann Junior High School. Estimated cost $340,000. A. M. Edelman and A. C. Zimmerman, 726 and 836 Heilman Bank Bldg., Assoc. Archts.

Conn., New Britain—Fafnir Bearing Co., Booth St., awarded contract for the construction of a 6 story, 60 x 160 ft. factory for the manufacture of ball bearings. Estimated cost $150,000. Noted Aug. 20.

Conn., Torrington—Torrington Specialty Co., will build a 40 x 60 ft. factory for the manufacture of automobile and radio accessories.

Ga., Manchester—Atlanta Birmingham & Atlantic Ry. Co., Atlanta, plans the construction of a railway shop here. Estimated cost $35,000. L. L. Beall, Brown Bldg., Atlanta, Ch. Engr.

Ill., Elgin—Elgin Clock Co. will receive bids about October 1 for the construction of a 1 and 2 story, 65 x 100 ft. factory. Estimated cost $150,000. Graham, Anderson, Probst & White, 80 East Jackson Blvd., Chicago, Ill., Archts.

Ill., Maywood—U. S. Veterans' Hospital Bureau, Washington, D. C., awarded contract for the construction of a repair shop, etc., here, $23,990.

Kan., Leavenworth—Abernathy Furniture Co., 1513 West 9th St., Kansas City, Mo., awarded contract for the construction of a 4 story, 80 x 300 ft. factory including lumber sheds, dry kiln, etc.

Md., Baltimore—Mayor and City Council, City Hall, will soon award contract for the construction of addition to school and shop at Warren and Battery Aves. L. R. White, Hearst Tower, Archt.

Mass., Allston (Boston P. O.) — O. F. Darley, 27 State St., Boston, awarded contract for the construction of a 1 story, 87 x 137 ft. repair and service garage on Brighton Ave. here. Estimated cost $60,000.

Mass., East Boston (Boston P. O.)—E. J. McHugh, 944 Saratoga St., plans the construction of a 1 story, 80 x 130 ft. repair and service garage. Estimated cost $50,000. Architect not selected.

Mass., Lawrence — O. F. Kres Co., 102 Concord St., is receiving bids for the construction of a 1 story repair shop. Estimated cost $40,000. Ashton, Huntress & Alter, 477 Essex St., Archts.

Mass., New Bedford—R. W. Powers, 501 County St., is receiving bids for the construction of a 1 story repair and service garage and show room. Estimated cost $45,000. E. M. Corbett, 70 Bedford St., Fall River, Archt.

Mass., North Adams—E. Vadnais & Sons, Centre St., is having plans prepared for the construction of a 2 story, 55 x 160 ft. repair and service garage and salesroom on Union St. Estimated cost $75,000. E. T. Barlow, Main St., Archt.

Mass., Roxbury (Boston P. O.)—H .B. Church Truck Service Co., 26 Reading St., is receiving bids for the construction of a 1 story, 72 x 112 ft. repair and service garage. Estimated cost $45,000. Shepard & Stearns, 65 Franklin St., Boston, Archts.

Mass., Watertown (Boston P. O.) — American Soda Fountain Co., 282 Congress St., Boston, is having preliminary plans prepared for the construction of a manufacturing plant here. Estimated cost $40,000. Monks & Johnson, 99 Chauncy St., Boston, Archts.

Mich., Detroit—Ford Motor Co., Highland Park, plans the construction of a 3 story, 67 x 851 ft. addition to building 4 on Livernois Ave. here. A. Kahn, 1000 Marquette Bldg., Detroit, Archt.

Mich., Detroit—Public Lighting Comn., East Atwater St., will soon award contract for the construction of the superstructure of a power house, machine shop, screen house, etc., for new municipal power plant on Morrell St. Smith, Hinchman & Grylls, 800 Marquette Bldg., Archts.

N. J., Jersey City—Manhattan Electrical Supply Co., 17 Park Place, New York, awarded contract for the construction of a 6 story factory on Monitor St. here.

O., Ashtabula — The Ashtabula Bow Socket Co., is receiving bids for the construction of a 1 story, 40 x 100 ft. factory. Estimated cost $40,000. Private plans.

O., Canton—Rogers Motor Sales Co., 2118 Tuscarawas St. W., awarded contract for the construction of a 1 story, 50 x 205 ft. garage. Estimated cost $150,000.

O., Coshocton — Beach Enameling Co., will soon receive bids for the construction of a 1 story, 60 x 146 ft. addition to factory. Estimated cost $55,000. Private plans.

O., Lakewood—Bailey-Buick Co., C. A. Bailey, Pres., 17602 Detroit Ave., awarded contract for the construction of a 1 story, 48 x 62 and 55 x 220 ft. sales and service garage. Estimated cost $150,000.

Pa., Philadelphia—Arguto Oilless Burning Co., 149 West Berkley St., is receiving bids for the construction of a 1 story, 46 x 47 ft. manufacturing plant. Estimated cost $6,000. Harris & Richards, Drexel Bldg., Archts.

Pa., Philadelphia — Ferco Machine & Screw Co., 4317 North 3rd St., awarded contract for the construction of a 1 story, 54 x 60 ft. factory. Estimated cost $50,000.

Tenn., Chattanooga—Crane Enamelware Co., 1316 Chestnut St., awarded contract for the construction of a foundry and machinery plant including a 1 story, 180 x 228 ft. enamelware building, 60 x 360 ft. grinding building, etc. Estimated cost $750,000.

Tex., Palacios—U. S. Government, War Dept., Lt. Col. L. Westbrook, plans the construction of a government training camp including blacksmith shop, etc. Estimated cost $500,000 to $1,000,000.

Va., Franklin—The Camp Mfg. Co., lumber manufacturers, plans the construction of a group of buildings to replace fire loss. Estimated cost $50,000.

Wis., Kiel—Kiel Furniture Co. is having plans prepared for the construction of a 1 story, 38 x 125 ft. addition to factory. Estimated cost $30,000. W. F. Neumann, 114 Grand Ave., Milwaukee, Archt.

Wis., Milwaukee—H. Schmitt & Sons, Inc., 430 Farwell Ave., awarded contract for the construction of a 2 story, 42 x 115 ft. shop on Burleigh St. Estimated cost $45,000.

Wis., Milwaukee—Sengbusch Self Closing Inkstand Co., 165 Michigan St., plans the construction of a 2 story, 60 x 120 ft. addition to factory on Clybourn St. Architect not selected.

Ont., Toronto—White Star Transit Co., 89 Dundas St., plans the construction of a 3 story garage and motor bus terminal on Dundas St. Estimated cost $170,000. Architect and engineer not selected.